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TRANSACTIONS

OF THE

ODONTOLOGICAL SOCIETY

OF

PENNSYLVANIA.

1884—1885.

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TRANSACTIONS

OF THE

ODONTOLOGICAL SOCIETY OF PENNSYLVANIA.

THE regular meeting of the Society was held January 5, 1884, at the residence of Dr. Daniel Neall, No. 1627 Summer Street, Philadelphia.

The following paper was read on

THE ETIOLOGY OF CARIES AT THE GUM MARGINS AND ON THE LABIAL AND BUCCAL SURFACES OF THE TEETH.

BY E. T. DARBY, M.D., D.D.S.

The subject selected for me by the chairman of the executive committee is a good one, and has the advantage of not having been frequently discussed in this society; but in order to treat it intelligently it demands a threefold division, for there are certain conditions existing in labial and buccal caries which are not present in the earlier stages of the disease known as erosion. There are also two unlike conditions existing in labial and buccal decay. In one the disease begins in the enamel, and after its substance is destroyed the dentine is involved. In the other the disease begins and ends in the cement and dentine; or if the enamel be involved it is only to a limited extent. When caries begins upon the enamel of labial and buccal surfaces of the teeth, it is usually preceded by a green or brown stain, and the character of the teeth attacked is usually poor; they are deficient in calcareous ingredients, and belong to the second or third order of density.

It is customary to attribute this stain to an abnormal condition of the fluids of the mouth, especially the mucus from the follicles of the gum, and in most cases the ordinary tests for acids will show such a condition present. Whenever this stain has been present the polish has been destroyed and the enamel roughened, and a chalky appearance given to the surface of the tooth. Unquestionably the cause assigned is a correct one. Precisely the same condition may be produced in the laboratory with any of the mineral or

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vegetable acids. Were I asked to demonstrate it, I would call it the labial decay of childhood, or the labial decay preceding puberty. The writer has frequently noticed it and all the conditions favorable to its advancement in young girls prior to their first menstrual period. In color it is generally white; in progress rapid. It would perhaps be asserting too much to say that the secretions of the mouth were always acid when such decay is found upon the surfaces under consideration, but the tendency is always toward an acid condition, and the writer feels confident that litmus-paper would show an acid reaction in at least eighteen hours out of the twenty-four. The treatment should begin early, and may be prophylactic, mechanical, and constitutional. If the green or brown be present it should be polished away with fine powder (never scraped away with a sharp instrument), and the surface of the enamel polished as beautifully as it is possible to do with oxide of tin or fine chalk. The acid secretions of the mouth should be modified, if possible, by frequently rinsing the mouth with lime-water, and at bed-time chalk may be packed around the necks of the teeth. Lactophosphate of lime and cod-liver oil may be given in combination in digestible doses. A diet of which the phosphates form a considerable proportion cannot but be beneficial, and plenty of exercise in the open air will complete the list of constitutional remedies.

But unfortunately the dentist is not always consulted until mechanical treatment is demanded, and this generally consists in cutting out the softened tissue and filling the cavities. But what shall be the material used in teeth of this description? To fill with gold is like building upon the sand. I am free to confess that I am New Departure enough to admit that gold under such conditions would be about the worst material that could be used, not because it is gold and incompatible with tooth-structure, but because there are other materials better. Phosphate of zinc stands at the head of the list for such cases, and next is gutta-percha. Either is but temporary, but while the teeth are yet in an uncalcified condition we must be content with temporary work. Gold would be but temporary now, though it were inserted with the greatest skill. All that we can hope to do, under the most favorable conditions, is to arrest the disease and wait for nature to help us out,—and nature will often do it. The writer has often seen the disease arrest itself before caries had penetrated the whole thickness of the enamel. If children could be taken at just the right time, and as it were turned out to pasture, I doubt not in very many instances we should find the caries stopping at the junction of the enamel with the dentine. This, then, is the labial and buccal decay of childhood. It begins in the enamel, may end there, or may consume the whole tooth-crown.

But there is another character of labial and buccal decay. It begins in the cement and dentine, and can hardly be called a disease of childhood. It is preceded by a recession or absorption of the gum, and its superficial extent is often bounded by the border of the gum above and the enamel junction below. In other words, that portion of the dentine which is deprived of gum-covering softens and disintegrates. It is necessarily a disease of middle life or advanced age, but it rarely presents itself until after puberty; neither is it frequently to be seen in the mouths of those who have soft or frail teeth. I would not be understood as asserting that the decay differs in character materially from that previously described, save in that decalcification is much slower in teeth of more dense structure. The recession or absorption of the gum is the first abnormal condition demanding our attention. I am aware that the cause of this is usually attributed to the tooth-brush or to too much friction. Doubtless in some cases this may account for it, but the writer is strongly of the opinion that there is something back of the tooth-brush which causes it. Some of the most pronounced cases I have ever seen have been in the mouths of inveterate smokers, especially in the cases of young men who indulge to an almost criminal degree in the use of cigarettes. I recall several such cases in my own practice, where the gums have been absorbed to the extent of about one-eighth of an inch; the surface of the dentine softened and exceedingly sensitive to the touch. General debility or nervous prostration would seem to be another favorable condition. I have from time to time under treatment two gentlemen, neither of them over twenty-five years of age, both of whom have suffered from general debility (or nervous prostration, as they are pleased to call it), in which there has been absorption of the gums to about one-eighth of an inch in extent from around the labial surfaces of the six oral teeth. Both of these gentlemen have teeth of an uncommonly good character,—very few approximal decays,—and yet it has become necessary to cut out and fill cavities in all of these labial surfaces. The ordinary test for acid in the secretions has not shown it to be present to an unusual degree, and both of the gentlemen in question are in the habit of cleansing their teeth with ordinary care. When caries of this character attacks the teeth, at the points indicated and at the period of life named, it does not often arrest itself. Constitutional treatment may retard it, local application may keep it in check for a time, but the operation of filling generally becomes imperative. But filling does not always arrest it, except in so far as the disease has extended at the time the operation is performed. Absorption of the gums continues, softening below and around the filling follows, and in a short time a larger filling is

demanded, because the disease has not been limited except by the extent of the gum's recession.

There is no class of operations which the writer is called upon to perform the result of which is less satisfactory than these. The plastics do not seem to fill the demand. Neither phosphate of zinc nor gutta-percha seems well adapted, partly because of the difficulty of making good margins near the gum-border. Gutta-percha is preferable to the phosphate of zinc for such positions, but should the upper edge of the filling impinge in the least upon the gum it is sure to produce irritation, which is followed by renewed wasting of that tissue, and the last state is worse than the first. Gold seems the best adapted for such cases, and because of the good character of the enamel tissue in teeth thus attacked it lasts better than it would do in teeth of softer structure. I would denominate this last-named as the labial decay of middle life; its cause both constitutional and local; constitutional in that there is a lowering of the general tone or stamina of the nervous system; local in that the mucous follicles are secreting an abnormal fluid,—and this, too, in consequence of a local irritation. I would preach against excessive smoking, especially the use of cigarettes. For treatment, make the best operations and direct washes of lime-water.

But the subject assigned me calls for the consideration of another condition, sometimes present upon the labial and buccal surfaces of the teeth, namely, erosion, and because it is unlike the two just described I was led at the beginning of this paper to give the subject a threefold division. That this disease is unlike the labial caries just described I am sure you will bear me witness. Authors of text-books have either passed it over in silence, or devoted as little space as possible to its consideration. Harris, in his work on "Dental Surgery," has devoted a chapter to it, consisting of less than three pages, which he denominates "Denuding of the Teeth." He does not attempt to explain the cause, nor does he more than hint at the treatment.

Garretson, in his "Oral Surgery," has devoted less than two pages to the subject, and left us as much in doubt as to the real cause as to the best mode of treatment.

Both Wedl and Magitot have devoted considerable space to the subject of erosion, but both seem to confound it with malformed or imperfectly developed teeth, and attribute it to a congenital defect or mal-nutrition while the tooth was in a follicular state; whereas almost daily observation has taught us that it occurs most frequently upon teeth perfect in development and at periods far remote from the time of eruption. It is a condition which more frequently than otherwise makes its appearance after the thirtieth year of age, and

instances are rare when it has been present at so early a period in life. I need hardly enter into a description of the disease, nor need I point out in detail its unlikeness to ordinary labial caries. Suffice it to say, that it more frequently than otherwise begins upon the incisors and cuspids, though it is frequently to be found upon the bicuspids and molars. It begins by a general wasting of the enamel tissue, sometimes at or near the gum, at other times midway between the gum and cutting-edge of the tooth. Sometimes its progress is indicated by transverse grooves having the appearance of being carefully cut or chiseled. At other times the grooves are longitudinal, and at still other times there is a general wasting away of the entire labial face of the tooth. The labial and buccal surfaces are more frequently the seat of disease than are the palatine and lingual, and yet in some instances these latter surfaces are eroded.

Unlike other types of labial caries, the surface is generally beautifully polished. Teeth thus affected are generally excessively sensitive to heat and cold, and especially so to sweet and sour. It may be confined to a single tooth or to the teeth of one side of the mouth only. It is sometimes rapid in its progress, and after progressing to the depth of the enamel covering is arrested; or it may be exceedingly slow in its progress, years elapsing before great destruction of tissue has ensued.

But it is easier to describe its appearance than to ascertain the cause. Among the few that have been enumerated, the acid theory seems to be most accepted. I am aware that the great majority of practitioners are strongly of the opinion that it is a condition produced by an acid reaction of the fluids of the mouth, more especially of the mucous saliva, and that the tooth-brush and dentifrice hasten its development. Such a theory is unsatisfactory, because the conditions favorable to it are not always present; neither are they present only at the period when such destruction takes place, but at no other periods during life. While it is true that external acids taken into the mouth may cause rapid destruction to tooth-structure, by dissolving out the calcareous ingredients, and while it is also true that acids generated in the mouth by the fermentation of articles of food, or liberated by the constitutional phenomena, may account for ordinary caries in a general way, it does not prove conclusively that the disease now under consideration is dependent upon this. On the contrary, the disease is often found in mouths in which the salivary secretions have been found not to be acid but rather alkaline or neutral, and some writers have gone so far as to assert that it is caused by excessive alkalinity of the oral secretions, and is not dependent in any way upon an acid state of the saliva.

Personally I am very loath to believe that it is an acid condition of the fluids of the mouth that produces it, nor am I more ready to believe that it is a combination of acid and friction from tooth-brush and dentifrice, as some would have us believe, and for the following reasons: First, the most pronounced cases I have ever seen of it are in mouths in which litmus-paper has failed to detect the slightest acid reaction, though the test for it has been made at all intervals of the day, both before and after eating. Second, because I cannot reconcile the facts that it occurs at or about a given period in life, and almost never in youth, although the secretions of the mouth may be intensely more acid between the age of twelve and thirty than between thirty and sixty years of age. Again, if the tooth-brush is the cause of it, either wholly or in part, why is it not found upon all of the teeth which are brushed alike, but upon a single tooth or the teeth of one side of the mouth only? Why are not my teeth thus affected, since I have brushed them heroically with tooth-powder for more than twenty years, and with brushes not lacking in stiffness? Why are not the teeth of most persons who use stiff brushes and dentifrices with the same care that I do affected by erosion of the enamel? Why are so many exempt from it when the assigned or so-called causes are so common?

At the risk of exhausting your patience, I shall present two marked examples of this disease which have developed under my own observation, the history and progress of which I have noted with peculiar interest. They are interesting because of their similarity, and also because of their unlikeness to each other. Both of them are in the mouths of maiden ladies, and, as nearly as I can judge, of about the same age, say from forty-five to fifty years. One of them has been a patient of mine at least fourteen years, the other perhaps ten. The quality of the teeth of each, when I examined them, would rank among those of the first order. I cannot describe them better than by saying that they were perfect in development, yellow in color, and as clean as the teeth of a hound. The ladies themselves were fine specimens of physical health, and both of them have recently assured me that from childhood they have enjoyed uniformly excellent health. Both of them say that they have never been in the habit of indulging in acid fruits, nor have they been in the habit of eating acid food to any considerable extent. Both of them have now and have always had good digestion, and, so far as I am able to ascertain, by frequent tests of the secretions of the mouth with litmus-paper, have normal salivary and mucous secretions. Under such conditions, we would naturally expect to find comparative freedom from caries and

exemption from enamel erosion; but such is not the case. They represent two of the worst conditions of erosion I have ever seen. At the time they came under my care there was no indication that such a condition was to follow; in fact, it did not make its appearance in either case until within the past five years. Let me briefly point out the similarity of the two cases, and then their unlikeness to each other. Both of them began at about the same period in life, and both have been progressing for about the same number of years. Both are single ladies, with temperaments and constitutions very much alike. The erosion has attacked the same teeth, the same surface, and has progressed to about the same extent in each case. Their unlikeness consists in the following: In one case the wasting away of the enamel and dentine-tissue has been attended with exceeding sensitiveness; in the other, none has been present. In one no softening nor decalcification of the dentine has followed, but the eroded surface is as smooth and polished as though it had but just come from the hands of a skilful lapidary; in the other the sensitiveness to heat and cold is excessive, as it is also to acids. While the surface of the enamel presents the same polished appearance, no sooner is the dentine exposed than decalcification ensues, and mechanical treatment becomes necessary. In one case the erosion is confined to the labial and buccal surfaces; in the other the wasting is general, there having been a gradual diminution of the whole crown of the tooth, the lingual, palatine, and approximal surfaces showing the same eroded condition. Fillings of gold which had been inserted and made flush with the surface of the enamel now stand out like islands in the sea, the tooth-structure having wasted away from around them. In seeking for a cause of this remarkable condition I have been baffled at every step. Each inquiry pointing to the probable cause has elicited a negative response. I have endeavored to persuade myself that it was nothing more nor less than an acid mucous saliva softening or dissolving the calcareous constituents of the tooth, and that the tooth-brush and powder did the polishing. Were the eroded surfaces the labial and buccal only, and the grooves all transverse, possibly I could do so, but when I find depressions—minute pools or basins, as it were—in the labial faces of the teeth, and these, too, most beautifully polished, I am led to believe that it is not the only cause. A remarkable coincidence has attended one of these cases, and while it may not be of value in helping us to determine anything positive, it is nevertheless interesting. When the erosion first began in one of these ladies' teeth she came to me and said, "See how my teeth are wasting away, and see also how gray my hair is getting. All this has taken place within the last few months." She had consulted the family physi-

cian, who is a Walnut-street practitioner and a gentleman of great prominence in the city. He said to her, "There is no lime in your system," and at once put her upon lacto-phosphate of lime and cod-liver oil; and now, whether he had made careful analytical test of her excretions, to determine if undue quantities of lime were being eliminated from her system, I did not ask, neither did I learn; but may it not be possible that the wasting of the tooth as indicated is owing in part, if not wholly, to a lack of lime-salts in the system? Speculation is not proof, but speculation may help us to discover facts, and, in seeking to find a satisfactory explanation of this remarkable phenomenon, I have sometimes wondered whether it might not be caused by excessive calcification of the tooth-substance. It does not come in childhood, when the tooth has a large percentage of animal matter in its composition; neither does it come in youth, but usually in middle life and in teeth of the best quality. May it not be possible that nutrition has ceased to reach the periphery of the dentinal tubes, and petrifaction has taken place? I am aware that such an argument has its weak point, because devitalized teeth are not proof against it.

A few words with reference to the treatment, and I have finished. Eroded surfaces are sensitive and need treatment. The best treatment would be the galvano-cautery, touching the eroded surface until sensation has abated. Nitrate of silver often gives relief, if applied faithfully and continuously for several minutes at frequent sittings. Chloride of zinc, applied repeatedly, will give relief. When softening of the dentine follows the erosion of the enamel, filling becomes necessary. I have been more successful with gold in such cases than with any of the plastics, but fillings protect only the point filled; the disease is only arrested at the place occupied by the filling. Whether constitutional treatment will avail anything, I am not prepared to say.

Finally, gentlemen of the Odontological Society of Pennsylvania, I propose for your consideration this evening the riddle of dentistry: Erosion of the teeth; the cause and best treatment.

Discussion.

Dr. Kirk. I have had two cases of erosion lately which are of interest; both patients were ladies and sisters, with a difference perhaps of five years in their ages, the elder not over thirty-five years. The teeth of both were extensively affected by the disease, but the manifestation of its action was different in each case. Those of the younger sister, from and including the first bicuspid on the left side to and including the same tooth on the right side of

the superior jaw, had deep concave depressions upon their labial surfaces at the necks, which in several instances extended to the approximal surfaces. Had it not been for this fact, and that small gold fillings were standing in the center of several of the depressions, from which the surrounding tooth-structure had dissolved away, leaving the gold high above the surface of the tooth, I should have attributed the condition to the abrasive action of brush and tooth-powders used too vigorously. Upon examining the lower teeth I found the incisors and cuspids affected in the same manner; the disease in the centrals extending over a considerable portion of their approximal surfaces, thereby excluding the possibility of abrasion from the brush. There was no evidence of any erosion upon the teeth posterior to the first bicuspids. There was slight carious action in a few of these polished depressions, which the patient insisted upon having filled with oxychloride of zinc filling. This I declined to do, believing that the secretions of her mouth must be acid. To assure both her and myself of the fact, I tested the saliva and the secretions about the necks of the teeth with Squibb's litmus-paper, and to my great surprise found both neutral, or if anything slightly alkaline. The cavities I filled with gutta-percha, the preparation of them causing very little pain. Upon questioning the patient as to the character of her food, and especially as to her fondness for acids, she acknowledged a strong partiality for food of this character, stating that it had been her habit for years to eat one or two sour oranges at bed-time; otherwise her diet was in no way peculiar. She was of a very highly-organized nervous temperament, and an almost constant sufferer from neuralgia. In the case of her sister the erosion presented a different appearance; the six upper front teeth looked as though their labial surfaces had been held against a grindstone and the enamel ground down as thin as tissue-paper and highly polished. The enamel upon the approximal surfaces was of normal thickness; the appearance presented being much the same as viewing the teeth in longitudinal section. Upon the labial surfaces of the cuspids, which were much flattened, having lost their convexity by the removal of enamel, a polished groove extended from the gum-margins to the cutting-edges in a tortuous line, which was entirely denuded of enamel and exquisitely sensitive. The first bicuspids each had grooves of erosion extending transversely across their necks. In the few instances where I have met this condition before I have found gold fillings more satisfactory than anything else, but have never seen or treated a case of erosion so extensive as these before, nor in any instance have I ever seen it in a patient under thirty years of age.

Dr. Jack. I have met with three characteristic cases differing

from any of those cited by Dr. Darby,—one being an example of true enamel erosion; one a peculiar form of erosion on the approximal surfaces of a cuspid and a central incisor, and the third an apparent erosion of the cutting-edges of the upper and lower incisors. The first case, at the commencement of the disorder, presented the appearance of a number of small pits, scarcely larger than the section of the shaft of a dressing-pin, on the face of a central incisor, and more highly polished than the surrounding enamel. They gradually grew larger until two grooves were completely established, and at last in the progress of the case they formed one broad line of erosion. Meanwhile other points were forming on other parts of the front teeth. This case is a typical one of true enamel erosion, on account of the spots being isolated, comparatively round, and highly polished; the effect of abrading influences being excluded; in but few points had the dentine been reached. The high polish of these depressions is a feature peculiar to enamel erosion, and an apparently anomalous phenomenon, since all other acidulous processes of solution of dental structure present dull and roughened surfaces. Loss of substance from the necks of the teeth, where the cementum has become exposed, may be the result of abrasion, and not due to this peculiar manifestation, which needs to be eliminated to enable the etiology of this affection to be determined with accuracy.

The second case was an exception to the usual surfaces affected. The eroded parts were very smooth, but afterwards became carious.

In the third case the destruction was limited to the ends of the teeth, and increased until a space as large as the thickness of the index finger resulted between the ends of the upper and lower incisors. These surfaces were not smooth, and, while not at all carious, were dull; though not irrregular, were like frosted glass or a metal bitten by an acid. In this case the solving influence was probably an acid mucus secreted by the follicles at the tip of the tongue, and enhanced by the habit the patient acquired of constantly applying the tongue to these surfaces.

Erosion has been attributed to the influence of the gouty diathesis. I believe this to be the case, since in nearly every instance of enamel erosion I have not failed to establish the existence of a tendency to gout. Charles Tomes states that the otaria are subject to the erosion of their teeth.

Dr. C. A. Kingsbury. For many years I have been greatly interested in the subject so ably presented in the paper read to us this evening. My own observation fully confirms in many respects the facts stated. I have noticed that the incisors and cuspids are the teeth more frequently affected, but have met with the disease in

many cases in the bicuspids and first molars. The erosive action is generally confined to the labial and buccal surfaces, forming grooves of a varying depth in a transverse direction and near the margin of the gum. I have seldom met with instances in which it has produced grooves in a vertical direction. In some cases there is considerable sensitiveness present on touching the denuded surface with the point of an excavator; but this is not generally the case until the disease has nearly exposed the pulp, and even then I have noticed that a reparative process has evidently been going on for the protection of the pulp by the formation of secondary dentine, or consolidation of the dentinal tubuli. In rare cases I have met with erosion upon the lingual surfaces of the inferior teeth. I have met with it upon the grinding surfaces of the cuspids, bicuspids, and molars, cupped out by loss of substance, and not due to mechanical abrasion in mastication, but to a process nearly if not exactly similar to that upon the labial and buccal surfaces.

I have no doubt that abnormal secretions, both salivary and mucous, having a decided acid reaction, as well as the various acids, such as lactic, acetic, and others, generated in all forms of indigestion, are important factors in producing erosion. In conjunction with these chemical agents we have a mechanical agency at work in the abrading and polishing friction of tooth-brushes and coarse dentifrices. But all these causes combined would not be sufficient to produce such effects if there was not some radical organic defect in the structure of the hard tissues. This is not only manifest in teeth of different individuals, but also in different teeth of the same individual; we also find a marked difference in the structure of the calcareous tissue of the same tooth, some parts of the crown being hard and perfect and other parts defective and imperfect. We have reason to believe that the process by which the carneous pulp with its soft cellular tissue is transformed by the deposition of lime-salts into dentine and enamel is liable to be seriously affected by systemic influences exerted through the circulation. This disturbance of the function of nutrition, by the vitiated secretions of the blood during their formation, would enable us to account for most of the histological abnormalities to be found in the human teeth.

In ordinary cases of erosion, however dense and normal the appearance of the dentine may be, this deficiency in organic structure, whether in the quantity, quality, or arrangement of the constituent elements, renders them more soluble by the acids present in the oral cavity. The treatment indicated in such cases is filling with gold,—which is the most reliable in the majority of cases,—gutta-percha, or oxyphosphate of zinc; the use of a weak solution of bicarbonate of soda or lime-water as a gargle two or three times a

day, and the employment of pure precipitated chalk as a dentifrice.

Dr. Chupein. I never believed that erosion was produced by the tooth-brush. The grooves are too narrow to be made in that way. I have always noticed it in teeth of the densest character. Its cause has always been a mystery to me. I cannot think that erosion is first produced by an acid action and the surface polished, as we always find it, by the action of the lips or by tooth-brush. If this were so we should find all the teeth acted upon alike, whereas we find erosion greatest in the incisors and cuspids, and seldom extending as far as the second molar. I have a specimen of erosion in a lower incisor, with the groove on the labial surface, while the lingual surface is so thickly coated with salivary calculus as to obliterate all shape of the tooth. I never saw a case of erosion of greater width than three-sixteenths of an inch nor of greater depth than one-eighth. When speaking upon this subject some time ago, the late Prof. Buckingham stated that he had a patient who never used a tooth-brush, and yet his teeth were eroded from the molar of one side to the molar of the other; furthermore, he said he had seen cases of this kind where an upper lateral incisor closed inside of the lower teeth, being entirely out of the reach of a tooth-brush; and yet this lateral incisor was as deeply eroded as the prominent central incisor and cuspid which flanked it on either side.

Dr. Guilford. I am very much pleased with the paper, especially with its full and complete statement of the condition of this peculiar lesion, but am disappointed in not hearing more as to its probable cause. Its symptoms are familiar to every practitioner, from the numerous cases we are called upon to notice in our practice. The attack is upon living teeth almost exclusively. Where it is found upon devitalized teeth, it has probably taken place before the teeth lost their vitality. While the grooves are mostly longitudinal, they are sometimes vertical and sinuous, appearing variously at any point between the cutting-edge and gum. All these peculiarities of location and condition must be met and explained by some theory to make it generally acceptable. For my own part, I have always been a believer in the chemico-mechanical theory. I cannot see how anything but an acid or combination of acids can dissolve so hard a tissue as the enamel; and since the action of an acid would leave the eroded surface rough, while we find it smooth and polished, I fail to see how this polishing could occur save by mechanical means in the use of the tooth-brush. Now, what this acid or acids may be I cannot say; careful chemical and microscopical investigation can alone determine it, and this has not yet been undertaken.

Attempt has been made to associate it with kidney troubles, and it may be that under such conditions an unusual quantity of uric

acid is generated in the system, and that the damage is done by it. To establish this association, however, we must determine by experiment the presence of uric acid in inordinate degree in the fluids of the mouth, and then it must be explained why it should occur in greater quantities in the region of the superior and especially the oral teeth.

It appears to me, also, that the condition cannot be constitutional and operative through the structure of the tooth from within outward, as some have endeavored to maintain, for it would then operate on all the surfaces of the teeth alike, as we know it does not. Whatever the cause of the lesion may be, it is certainly one of the most alarming conditions that we meet with, because we can neither explain its character nor suggest a plausible remedy.

Dr. Leech. I saw a case of a molar affected by erosion on the palatine side, the groove being quite deep and highly polished, which certainly could not have been done by the use of a brush or tooth-powder.

Dr. Kirk. I would like to ask if true enamel erosion ever occurs in pulpless teeth?

Dr. Darby. I have had one case where erosion took place after the pulp was devitalized.

Dr. Truman. In order to understand this subject it is necessary to review the conditions that existed in the mouth subsequent to the entrance of the saliva in the oral cavity. It is well known that alkalinity is the normal condition of the saliva, but this does not exist when combined with the other secretions. It then gives a neutral reaction. In a long course of testing I have never met with an absolutely acid reaction. Now, it is to this neutral character that we must look for a reasonable explanation of caries as a whole, and of abrasion in particular. Neutral solutions rapidly change to acid if they are given proper conditions. During the hours of greatest activity, when the flow of saliva is constant through and around all portions of the mouth and teeth, there is little or no change, and test will not give any decided response of acidity anywhere. These well-known facts have led many to suppose that the destruction witnessed was not a chemical change, produced by acid solution, but probably an alkaline action. That this view was and is an erroneous one is clearly evident from the fact that no change occurs in teeth immersed in the strongest alkalies, the inorganic material and basis-substance remaining unaffected by months of immersion.

These undisputable facts render it necessary that we should examine further, and trace if possible the change that takes place in the secretions some time in the twenty-four hours. The alkaline theory is untenable. The idea that there is some interior destruc-

tive action going on is equally unreasonable. Decalcification is always a change produced by chemical means. These abraded teeth are dense teeth, more than ordinarily so, and there is no evidence that this action could by any possibility originate by and through the tubuli of the body of the tooth. It is an external action, and the cause must be looked for in the fluids that environ the teeth. Now, we know that these furnish no satisfactory explanation during the active period of life. Is there anything to be learned from a period less active, or one of entire rest? Now, it is well known that the flow of the secretions is markedly lessened at night during sleep; in fact, the extreme dryness is oftentimes unpleasant, giving the whole mouth a parched feeling. The alkaline saliva enters the mouth in but small quantities, not nearly sufficient to neutralize the acid generated, and the result is that, if tests are made at the moment of awakening, the acid reaction is marked. Hence it is evident that the destruction of teeth principally occurs at night. The entire mouth is in a state of rest. The fluids collecting before retiring in all depressions between the teeth on approximal surfaces, on the labial portions where the lips rest against the teeth, and in all pits or pockets, there is destruction going on silently but surely. It may be asked, How do any escape if these statements be true? Very few indeed escape caries,—perhaps none. Some do escape up to middle life, for it is about this period and later that the greatest evidences of erosion are manifested. It must be remembered that about this time there is an evident change in the secretions, and doubtless increased acidity at night; though this has yet to be experimentally demonstrated as existing to a greater extent after middle life than in younger years.

The conclusion is that abrasion is a purely chemical action, produced by acid secretions, and promoted by contact of the soft tissues, as the lips on the anterior teeth.

The highly polished surface may be explained by the constant action of the lips and articles of food. It is precisely the same as the polish of so-called eburnated dentine, where that clearly originates in constant attrition. In regard to Dr. Kirk's illustration, it would seem as though the eating of the orange before retiring invited the very conditions necessary to acidity and destruction during the sleeping hours.

In the case mentioned by Prof. Darby there was evidently no exactness in testing. Unless this was done at the proper moment, the results would be of no value. As soon as the parts arouse to action the secretions resume the character normal to day-time by the increased inflow of the saliva.

Dr. Jack. The cause is probably the acidity of the mucous secre-

tions of the lips and gums. Its neutralization in the back part of the mouth by the alkaline saliva of the parotid glands may limit the disease to the eight or ten front teeth. In the same manner, the general salivary contents of the mouth may limit its extension towards the approximal borders of the labial surfaces of the front teeth.

Dr. Guilford. I am glad to see that Dr. Jack at last comes around to the acid theory.

Dr. Jack. While the application of these general principles throws some light upon the cause of this peculiar disease, which, fortunately, is not a common one, still I think it yet remains inexplicable in the present state of our knowledge.

Dr. Kirk. In the mouth of one of the cases which I cited was a molar filled with one of the basic zinc-oxide fillings, with no evidence of disintegration, and which had been inserted previous to any appearance of erosion. This, to my mind, would exclude acids as a cause, the existence of such fillings being incompatible with an acid condition of oral secretions.

The regular meeting was held Saturday evening, February 2d, 1884, at the office of Dr. C. A. Kingsbury, 1119 Walnut Street. Dr. Essig was called to the chair.

A paper was read upon

THE RELATIONS OF THE TEMPORARY TO THE PERMANENT TEETH.

BY C. R. JEFFERIS, D. D. S.

The subject was partly suggested by the paper read before the N. Y. O. S. by one of our most prominent members, and reported in the December number of the *Cosmos*. I refer to Prof. Darby's essay on the "Treatment of Children's Teeth." The subject he there presented is the one it was my intention to bring before you, but he has afforded me the pleasure of having my views more ably handled in the expression of his own than I could possibly have done it, and while, therefore, I cannot take issue with him, he has at the same time given me a cue for another theme, though I think one not so rich, for while he says, "I had not intended speaking of the temporary teeth with reference to their in-

fluence upon the permanent ones," the treatment of the temporary teeth must in a measure be modified by their relations to the permanent.

When we make our wide separations (spoken of in his paper) between them, to arrest approximal decay, instead of filling them, why do we do it? Because we expect these teeth to stay for a short time only, to be then replaced with those that are to be guarded with all the care that can be bestowed upon them, and because we can thus more readily, and with less pain to our shrinking little patients, arrest the decay than if we excavate and fill. Therefore, we adopt a mode of procedure entirely different from that which we would apply to the permanent teeth. They are "treated" then, for the time being, with the early appearance of the permanent teeth in our mind, and they influence the latter by acting as guides to them in finding their proper positions in the jaws. Given sufficient space, and the rule with the permanent incisors is for them to occupy their place without interference from the dentist, and what more beautiful guides could the *bicuspidati* have to place them than the roots of the several deciduous molars between which they grow, and whose enfolding embrace secures them from any improper influence to become misplaced until they approach the surface, when the temporary tooth, having fulfilled its office, and its roots having been absorbed, drops out and the new organ takes its place just where it should. This, however, is presupposing that every temporary tooth has been retained, as it should be, until its function has been fulfilled. With the assistance of the parents, without which our best efforts will often fail, these teeth can be kept, if not as whole teeth, then as conserved and useful roots which will serve to hold in check the forward movement of the posterior teeth, and where they are so kept there will rarely be cases of irregularities, unless they are hereditary.

We frequently find the eruption of the superior central incisors taking place diagonally, or twisted, across the alveolus and causing distress to careful parents, but we know that if we give them sufficient space in which to turn they will generally do so, being assisted, as they lengthen from growth, by the inferior incisors engaging them on the side presenting lingually, acting as a motor in turning them.

I feel that it may be inopportune to speak here of the injury done to young mouths by practice of extracting the temporary lateral incisors to give more space to the permanent centrals than is provided for them by their own temporary predecessors; yet we know it is done every day to relieve the crowded condition of such teeth, space for eruption of which should be left to be provided for by the natural growth of the maxillæ; they are entitled by the natural law to such space only as was occupied by their predecessors, together with that which is gained by growth, and if we appropriate for them the space that should be reserved for the permanent laterals, where are we to place the latter? The centrals then have more

room than they require ; the canines, obeying their well-known inclinations, move forward to close up the space between them and the permanent centrals.

The laterals now having no proper place to erupt, present either labially or lingually to the line of the other teeth. Now the same person, miscalled dentist, who committed the first blunder, makes one still worse by extracting the cuspid, which was originally the key to the situation, and which it was of the utmost importance to preserve. The temporary canines having been sacrificed, and the permanent lateral presumably falling into its place, in due time the first bicuspid makes its appearance and moves promptly forward, taking its place beside or near to the lateral, the second bicuspid in its turn taking position beside the first. The patient now having arrived at the age of ten or eleven years, we see approaching a problem that could have been prophesied years before. Such teeth as are erupted may be in line forming a good arch, but it is apparent that the permanent canines not yet erupted will soon appear, usually on the labial surface of the alveolar ridge and between the roots of the lateral incisor and first bicuspid. What is to be done ? We must not extract the canine upon its appearance, as we know has been done. If the size of the arch is correct and not contracted we must sacrifice either the lateral incisor or first bicuspid, the choice depending largely upon the position of the cuspid and the direction of its long axis. If the tooth is in the position usually assumed in such cases, it is preferable to extract the first bicuspid and move the cuspid back by one of the ligatures commonly used in such cases. Should the point of the erupting tooth lean backward, however, indicating the apex of the root being close to or overlapping the root of the lateral, it would be manifestly improper to extract the bicuspid, and we are left with, at the best, a sorry choice between the sacrifice of the lateral, and disfiguring the mouth more or less by pushing the cuspid in it place, or, worst of all, extracting the cuspid and thus putting away the difficulty at once.

These remarks apply with almost equal force to the inferior teeth, although, for obvious reasons, it is customary to accord them a consideration secondary to the superior. We frequently see the inferior permanent centrals erupting lingually to the temporary, with the latter still firmly fixed, causing alarm to parents when first noticed. This, however, is ungrounded. Should these temporary teeth be extracted at once, upon their appearance, we lose space, ofttimes, by the crowding in of the laterals before the new centrals are sufficiently far advanced and firmly rooted to resist their encroachment, but if we allow them to remain until the crowns of the permanent centrals show from one-third to one-half their length before extraction of the temporary, we retain the space, and the new teeth will move forward into their places before

any crowding by the laterals can occur, or, should they not take their places for the want of sufficient space, the natural expansion of the jaw will usually permit them to do so later on. The same practice will hold good with the eruption of inferior permanent laterals. Irregularities, after all the permanent teeth are erupted, is a matter coming under another head, with which the present subject has nothing to do.

It is advised to separate, widely, the distal surface of the temporary second molar from the sixth-year molar. I hope I may be pardoned for raising the doubt as to the propriety of doing this indiscriminately. It is undoubtedly good practice in such cases as where the teeth are soft and incline generally to decay, for we frequently find the temporary molars decaying approximately and nowhere else, but, on the other hand, we see cases without any approximal decay; would it be proper to "anticipate" to the extent of cutting away these teeth, for fear there might be harm done to the sixth-year molars? Certainly not; not only because of the integrity of the teeth themselves, but for another reason, viz., the occasional absence of the germs of the second bicuspids. It should be remembered that this sufficiently often, to keep us on our guard against mutilating a tooth, that time may prove necessary to preserve, to fill a place that should be occupied by a successor, but is not.

Believing that, next after the lateral incisors, the second bicuspids are the teeth most likely to be missing, how important it is that we should not lose sight of this when treating these second temporary in their relations with the sixth-year molars.

If, from the presence of approximal decay in the other temporary teeth, we have cause to suspect it between the second temporary and sixth-year molars, obviously there is no better practice than to freely cut away the distal surface of the temporary molar, making, in so doing, an opening very wide at its coronal surface, allowing it to narrow as it approaches the cervix, but leaving, at that point, a moderately well-defined shoulder or angle. I would have, in no sense, a V opening, which, deservedly becoming an obsolete practice with the permanent, is quite as bad for the temporary teeth, the difference in the two cuts consisting in the width of the cut as a whole, and particularly in the angle at the cervix, which prevents food from passing beyond it, to become an irritant to the soft tissues.

It may be asked, How are we to know whether these bicuspids will appear or not, and whether it is worth while preserving the second temporary molars beyond the period at which they are usually shed? Our duty to our patient demands that we keep every deciduous tooth possible until we have the unmistakable evidence that its successor is near at hand, evidence that every one is cognizant of. But when the temporary tooth is still firmly set, with no apparent absorption having taken place,

and there are no indications of the presence of the permanent in the jaw, we should feel the sting of remorse if we had mutilated serviceable deciduous teeth, simply to "anticipate" that which might never have occurred, and the doing of which may prove to be an annoyance, more or less, through all the years during which the teeth remain.

While, therefore, it is good practice, and I think the best, to freely separate the temporary teeth where there is approximal decay, or indications that it will occur, it should be performed in the proper manner, with the full knowledge that some of the organs under our hands may be required to perform the functions of other and better ones during the natural life of the patient.

I have here brought before you something upon which we are all called upon, every day, to pass judgment, one not new, perhaps not apparently originally treated, yet the principles advocated are those which have yielded me such a large percentage of success that I make so bold as to crudely advance them to you.

Discussion.

Dr. Daniel Neall. This topic is very interesting. In properly regulated families, children should not know what toothache is. Granted, the continued elevation of the standard of dentistry and concurrent enlightenment of patients, then in intelligent and well-to-do circles, toothache should, with children of such, at least, become obsolete. Time was when parents were indisposed to bring the children to the dental office, not properly aware of the danger of neglect and trusting to luck, rather than care, for escape from tormenting nights.

I recall the time when I did not, in devotion to the permanent teeth, find time to fill the temporary. For many years I have reformed all this. And it is an indication of advance all around, that children now agree, cheerfully, to come to us, when, formerly, they would pull the bell and run away, or cross the street, to avoid us. They now approach us with confidence, of which we may well be proud. And it is well to remember that, in converting the children, we have exerted a moral influence upon the family.

Dr. E. H. Neall. I quite agree with Dr. Daniel Neall that a child should not be troubled with toothache from temporary teeth, and possibly would not were the proper care taken with them by its parents.

To-day I had a little patient, aged two years and four months, for whom I placed in six fillings; her teeth, at that tender age, being badly decayed. The week previous she had been obliged to take nitrous oxide to have a tooth removed which had given severe pain, terminating in abscess. This little patient, like many others, had not received the care

that her teeth needed, in the belief that she was too young to require it, and her parents had no idea of the condition of her teeth until pain set in.

I believe that, generally, the teeth of very young children are much better cared for at the present time than formerly.

Dr. Guilford. I do not advocate the indiscriminate cutting away of the temporary teeth to prevent decay in the permanent molars. It makes a receptacle for food. If the tooth is sound, I do not cut away. If it is decayed, I fill it. Deciduous teeth should be filled and kept until the permanent ones are in view. If a temporary tooth is kept in too long it may push the permanent one out of line. The canines should be allowed to remain as long as possible until the space is enlarged, when the permanent ones will fall into space. We should be cautious and do nothing unless absolutely necessary.

Dr. Jack. It is doubtful that any changes occur in the maxillæ proper in consequence of the early extraction of the deciduous teeth, but it is unquestionable that marked alterations take place in the alveolar process after the removal of these teeth, when performed considerably in advance of their time to be lost. The development of the alveolar border is checked apparently, because the nutritive supply is diminished to that part. This is illustrated by the result of extracting the deciduous lower incisors when the permanent teeth appear back of them in a crowded condition, and of permitting all to remain together; in the former case, the irregularity usually is fixed; in the latter, the general result is a natural correction of the disarrangement.

Besides, if any tooth is early removed the space is partly closed by the force which disposes the teeth to advance towards the front of the mouth. This force is persistent and has considerable power, which is demonstrated by the difference found in the results between forcing teeth forward and backward. In the former case there is little difficulty, but in the latter the resistance is determined and requires much more time and force to overcome the manifest resistance.

Dr. C. R Jefferis. I recall a case where a child eighteen months old had the incisors decayed even with the gum and abscessed. Treated, excavated and filled with gutta-percha. It has been over three years since and they were in good condition when I saw them last summer, and he could eat with them.

Dr. J. A. Woodward. I find that it is best not to isolate the temporary molar teeth, and prefer a V-shaped space with a firm shoulder near the gum to prevent wedging of food during mastication, or to restore the contour of the teeth with amalgam.

Dr. Register exhibited a new style of artificial tooth of his invention, having a deep cavity, with a headed platina pin imbedded within the cavity. Intended for celluloid and rubber work.

The regular meeting was held Saturday evening, March 1st, 1884, at the office of Dr. Register, 1907 Chestnut Street, President Truman in the chair.

INCIDENTS OF PRACTICE.

Dr. Jack. I would suggest a discussion of the comparative results of the devitalizing of the pulps of deciduous teeth and filling the pulp chambers, and the common one of leaving that chamber unfilled and then drilling an opening into the chamber at the neck of the tooth.

It has been my experience that the latter practice is followed by much greater subsequent disturbances than the former, the different inflammatory conditions which arise involving a considerable part of the gum, that structure assuming, in some instances, the appearances akin to purpura. This appears to be due to the artificial fistula permitting a free entrance into the chamber of various substances capable of fermentation, as well as directly, septic influences. By the former method, the irritation is less, because there is no receptacle for foreign matter, and few secretions, and should a fistula become established the sides of it are in contact in such a manner as to prevent ingress of foreign influences. So great is the difference of these two methods in my hands that I have ceased to drill these teeth.

To destroy the pulp of temporary teeth I bare this part and with a very fine broach prick a small quantity of the arsenical paste into the surface. This can be done with a light hand without giving pain, as the pulp of these teeth is not sensitive to touch unless pressed upon. In three or four days the devitalization is usually complete.

Dr. Martin. The results of my treatment of exposed pulps in deciduous teeth have been in the main unsatisfactory. In these cases I proceed in much the same manner as Dr. Jack has just described, destroying and removing the pulp as in a permanent tooth, and filling the cavity but not the canals. I have attributed my failures, in general, to a want of thorough work, it being sometimes difficult to operate for these little patients. I seldom use the tap-hole at the cervical margin of a tooth.

Dr. J. A. Woodward. Many pulps of the temporary teeth come to us in such conditions that they may be destroyed by one or two applications of creosote. Usually fill the pulp cavity and cavity of decay with oxy-chloride of zinc, including the most accessible portions of the canals in the root. As to the absorption of the roots of devitalized temporary teeth, I have specimens where absorption has taken place, leaving the material with which the root had been filled standing alone.

Dr. Wood. My general experience in capping with oxy-phosphate is failure. Its irritating effects I have failed to get rid of. I do not place it directly upon the pulp but use an intervening substance, frequently a

very thin wafer of gutta-percha placed over the opening without previous heating, and then tacked at the edges with the heated point of a small burnisher, the wafer gradually settling to place under the warmth.

Dr. G. Roberts. Where the pulp is dead I always open into the pulp chamber under the gum for the escape of gas. I have had no success in capping exposed pulps; the air sealed up in contact with them will eventually destroy them and give trouble. I seal up applications with oxy-phosphate when practicable. I find it gives less pain and will not let the medicine escape and poison the gums.

Dr. James Truman. In former years the practice was, probably, universal to use arsenious acid in deciduous teeth with exposed pulps; but I do not regard this the best mode at the present time. Dr. Jack's process of pricking it with the pulp would seem, to my view, a very difficult one, when we take into consideration the excessive nervousness of children. If pulps are freshly exposed, cap them as in adult's teeth. In pulpitis of long standing treat by the usual process and then cap.

It appears to me that we are losing sight of the action of agents, or what is desirable to accomplish by capping. If by capping we mean simply something that will protect the pulp from the pressure of the filling, then the antiquated modes of fifty years ago would answer; but we require something more than this. As a mere covering, oxy-phosphate will answer, perhaps, a better purpose than gold, but, in my judgment, is not fit for the purpose. Experience has demonstrated that a pulp rarely retains its vitality after long irritation. As entire devitalization is an almost certain result, we must secure an agent that will prevent after-decomposition, and this exists in a marked degree in the oxy-chloride of zinc. I know of nothing that has the same penetrating power and will mummify a pulp as effectually. The non-irritating property of the oxy-phosphate is of very slight advantage and does not compensate for the loss of the very important property mentioned existing in the oxy-chloride.

The destruction of the deciduous pulps is not called for, nor is it necessary to fill the root canals. Absorption takes place, and the filling must remain as an irritant.

The drilling a hole for vent, in these teeth, is, in my opinion, of doubtful value. While it permits egress for the gases of decomposition, the putrefaction process goes on continuously, and the increased development of germ life will aggravate all the symptoms. Treat the pulps with those agents that combat the products of decomposition, and then cap with oxy-chloride, and the result will be more satisfactory.

Dr. E. H. Neall. I think it probable that I have used oxy-phosphate filling (mostly Weston's) more than any gentleman present, and have been quite enthusiastic with regard to its merits, until about one year ago, since which time I have had so great a number of failures with the

material, as a filling for the approximal surfaces of bicuspids and molars, that I have discarded its use entirely, in such places. As a crown filling, it is a success, in many instances lasting from four to five years, with very little signs of wear. As a filling where gold crowns cannot be used, I think it invaluable.

As to capping exposed pulps, I always use a disk cut from a thin sheet of lead, which, upon being made cup-shape, by bending with the plyers, is then filled with a mixture of carbolic acid and oxide of zinc, and laid over the pulp; a filling of either oxy-phosphate or oxy-chloride, is then made. Teeth so treated have seldom given trouble, unless some inflammation of the pulp had been present before or at the time of filling.

When the deciduous teeth are badly decayed, the pulps dead and gums ulcerated, I advise extraction, otherwise, I fill with some temporary filling, usually oxy-phosphate in the crown cavities, and amalgam in the approximal surfaces.

Dr. Jack. As an illustration of the extension of the vitality of the root portion of the pulp, I have in my mouth a bicuspid where the body only of the pulp was devitalized. The live portion, after being made healthy, was covered with a paste composed of oxide of zinc, and a menstrum of equal parts of oil of cloves and carbolic acid. The thermal response of the tooth, which has continued for several years, indicates the vitality of the remaining field of pulp tissue.

As the discussion has drifted into the preservation of the pulp, I am free to say my confidence has continued to increase in the propriety of conservatively treating the dental pulp. Since adopting the method described by Dr. King, I am safe to say that not more than twenty-five per cent. are failures to maintain the vitality of that organ. The fundamental principle to be kept in view is the avoidance of pressure, even the least being fatal. This is done by selecting a concave cap of suitable size and form, filling it with the paste before described, and laying it carefully over the part of exposure. The temporary filling can then be inserted. The medicated contents of the cap serve two purposes—it fills, completely, the space between cap and pulp, to prevent the accumulation there of exudations anæsthetic and antiseptic, and its properties are salutary. It should be mentioned that the surface of the pulp is carbolized previous to this step in the treatment. I have had repeated presentations of the deposits of secondary dentine, the shortest one being in two years from the date of treatment, but have observed many pulps, after several years, in the exact condition they were when treated. Even in these instances, the result is better than devitalization of the pulps.

Dr. Wood. I would like to ask what may be considered a usual length of time for treatment of tooth-pulps with arsenical preparation?

Dr. Jas. Truman. The extent of the destruction will depend on the

amount used. When one-thirtieth of a grain is brought in contact with the pulps, the paralysis of this organ will be more complete, but the very minute quantity of one one-hundredth of a grain will, if given proper conditions, sufficiently accomplish the work desired. The arsenic should be removed in twenty-four hours, whether used in the larger or smaller quantity. It is not essential that devitalization should extend to the apical foramen. It is far better that it should not. In my judgment the upper third should not be affected at all.

Arsenic acts by first paralyzing the sensory nerves, and death or devitalization is not immediate; indeed, sensation may be temporarily revived in a pulp after apparent death.

Dr. Wood. Three days is the longest time usual with me for the treatment with arsenical preparation. If I can succeed in bleeding the pulp preparatory to treatment, I can frequently devitalize in much less time. I do not use more of the preparation than would amount in bulk to the head of a good-sized pin. If after treatment and in extracting the pulp I fail to get a little bright blood from the apex, I feel that my treatment is a failure, in that it has been carried too far.

The extremity of the pulp may be bright and healthy looking and yet appear considerably benumbed by the treatment.

Dr. Tees. I very seldom use arsenic—probably not more than a half dozen times in a year. In case of an exposed pulp in a deciduous tooth, I syringe out with warm water, remove the *debris*, apply a pledget of cotton dipped in pure coal tar creosote, and seal it in with plastic amalgam. This can be manipulated so as to prevent pressure upon the pulp. For capping exposed pulps in the permanent teeth I use the same creosote and chloride of zinc applied upon asbestos felt. I secure this in position by means of thin oxy-phosphate and then cover it with a harder material.

The regular meeting was held Saturday evening, April 5th, 1884, at the office of Dr. Jack, 1533 Locust St., President Truman in the chair.

The following paper was read upon

THE PRESENT SYSTEM OF EDUCATION A PROXIMATE CAUSE OF DENTAL DECAY.

BY THEODORE F. CHUPEIN, D. D. S.

It is not our purpose to write anything about Dental Education: we leave that to the faculties of our different dental colleges, who, we feel quite sure, are well qualified for their position, and have the experience of time to aid them in their duties. So many dentists write on this subject that it is nearly threadbare. Each has his plan, his idea, his objections, his theories, in relation thereto; and many imagine that unless *their* particular plan of instruction is carried out, no student could be properly graduated. It may be well to ventilate the subject, but, as we said, we feel that each professor of a dental faculty knows best how to impart the instruction coming under the scope of his chair, and what points will be most useful and serviceable to those under his tuition.

The object of this paper is to call attention to education generally—to the education of the masses and its relation, through the system, to the dental organs; as likewise to induce a concert of action on the part of the medical faculty to endeavor to correct what we cannot but believe to be a crying sin and abuse.

We believe that there is not a man here but can testify to the fearful condition of the dental organs of the children of both sexes that are sent to us for care or treatment of their teeth. We say this without fear of contradiction—except in some very few instances—for we cannot believe that *we alone* find that excessive decay spoken of. It is no infrequent thing to find from twenty to thirty decayed places, and sometimes more, in the teeth of children from twelve to fourteen years of age sent to us for treatment; and often we find teeth so irreparably decayed that little else remains to be done but extraction or patching, which is alike unsatisfactory to both patient and operator.

We are often asked, and we often put the query to ourselves, "What *is* the cause of this excessive decay?" We reply, frequently, "A physical degeneracy of the people of the present time," but we con over the subject, and sift the matter in our mind, and think that among

the many causes it may be due also to some of which we shall speak in this paper.

It is needless for parents to seek the opinion of dentists as to the condition of their children's teeth, or of medical men as to the cause of the condition of their general health. The fact is apparent, and a walk along our principal thoroughfares will satisfy any reflecting person on these heads. Innumerable signs and door-plates notify the passers-by of doctors, dentists, aurists, oculists and specialists in every branch of medicine and surgery. What is the answer to these reflections?—That there must be employment for all these practitioners, or else they would not pursue these callings; that people must be sickly or ailing, or else there would not be men devoting their time, skill and study in the effort to cure or alleviate suffering. Have we not also other evidences of weakness in the growing population? Yes, most certainly! Look at the many children we meet at school hours with curved spine, club-foot, bow-legs, knock-knees, curved shoulders, chicken-breast, one leg shorter than the other, near-sightedness, and all more or less pale and delicate and lacking the ruddy glow of health!

When parents accompany their children to our office and ask the cause of the excessive decay of the teeth, we can easily satisfy them that not alone are their teeth defective, but their whole general system as well. Many of them confess that they have the doctor constantly in attendance on their children; the children have no appetite, are listless, without animation; others that they have had to take their children from school, as they have nervous spells, low spirits, hysteria, headache, dyspepsia, St. Vitus' dance or heart disease. In nearly all such reports from parents we have but one answer—excessive study or cramming at the schools. All inveigh against it, but none, it seems to us, have the strength of mind to put down the abuse. And what is the abuse? It is the *multiplicity* of studies which is imposed on the children which is breaking down their constitutions and sapping their physical systems. We believe that our children's mental powers are overtaxed and overstrained, without a commensurate supply of physical exercise to counterbalance this tension, and as long as this system of education is persevered in we may not look for any amelioration—certainly no improvement in the general health nor in the dental condition of our children.

Let us merely name over the course of study pursued in nearly all of our private and in many of the public schools. There are Latin, Greek, French, German and English, English history, general history and history of the United States, reading, writing, spelling, definitions, writing by dictation, writing compositions, besides writing French, German and Latin exercises at home, and learning by rote irregular verbs in these languages. Then there are map-drawing and drawing from nature, geog-

raphy, algebra, arithmetic, the roots or derivation of words, synonyms, astronomy, botany and natural philosophy, elementary studies in chemistry, anatomy, physiology and geology. Then there are days for mythology, zoölogy, mensuration and geometry, lessons in elocution, in vocal culture and in some of the schools shorthand or phonography is taught.

These studies are pursued in class-rooms where there are seldom less than from forty to fifty children congregated, and in winter time with a raging heater pouring into the already vitiated apartment, emanations from the furnace of carbonic gas to commingle with the emanations from the 100,000,000 pores from the bodies of the assembled children, making the atmosphere, at times, positively stifling.

Besides the studies we have enumerated, many of the children of those better off have lessons on the piano or harp, or singing lessons, or perhaps lessons in painting or art needle-work for girls, or lessons on the violin, flute or cornet, and lessons in book-keeping for boys.

But we have mentioned only the *names* of the studies pursued, and we feel quite sure that any of the boys or girls at the private or public schools would consider they had a short lesson to learn if the teacher assigned four pages or less of each study. But this is not the case. Many times have we known of a lesson of twenty to twenty-five pages of history given to learn, besides some four or five other lessons ranging from five to eight pages each, together with the writing of exercises, letters, compositions, &c., &c.

The *Public Ledger* has almost weekly complaints like the following: "'CRAMMING,' NOT TEACHING. *Mr. Editor*—Will you please give space for the statement of an anxious parent, who desires his child to receive an education, but not at the expense of her health? The lessons to be recited to-day, after studying them the previous night, are: In etymology, six words, their definition, prefix, root and sentences. In geography, twelve questions, consisting of rivers, their location, the countries they drain and where they empty; the names of the rivers are the Dwina, Petchora, Vistula, Oder, Rhine, Elbe, Loire, Tagus, Seine, Douro, Rhone and Ebro. In spelling, twenty-four words, and in arithmetic, eight examples in fractions, to be done on paper; and this for a child ten and a half years of age. I thought with the advent of a new superintendent there would be a new system of study, which would relieve the parent from becoming the preceptor instead of what is called a teacher at school, who receives a salary for hearing recitations."

We heard a popular teacher say, at one of the annual commencement exercises of his academy, that "*Home* was the place for study and *school* the place for reciting lessons." All parents report that their children are ever at their lessons, that no sooner are they home from school, they eat

their meals (generally in a hurry—when they eat at all) so as to get at their lessons for the next day; that this is kept up until nine or ten o'clock at night, and that the children are up as early as six o'clock in the morning, either to go over what was studied the night before, or to get at some lesson which could not be undertaken the night previous. Some parents have told us they have noticed nervous twitchings in their children, which we felt sure were the forerunners of St. Vitus' dance, if not of some more serious complication—and even their sleep was restless and disturbed by moaning and movement, and repeating disconnected sentences of their studies, proving that what should have been a time for recuperation to both mind and body was otherwise—brought about by overtaxed mental strain.

It seems to us, too, that the character of some of the studies is absolutely useless. We will mention one or two examples. A child will probably have five or six such as the following to be prepared at home for the teacher's examination the next day: "A cistern contains 8765 gallons of water. It has five faucets, each of different calibre. The first, if allowed to run, will empty it in three hours, twenty minutes and ten seconds; the second in four hours, eight minutes and three seconds; the third in five hours, two minutes and twelve seconds; the fourth in five hours, fifteen minutes and two seconds, and the fifth in six hours and twelve seconds—how soon will the cistern be emptied if all the faucets are permitted to run at the same time? Or it is computed that the sun is 95,000,000 of miles from the earth—how long would it take a cannon ball to reach the sun if the ball traveled at the rate of forty-five and three-sixteenths miles per second?" Now, of what possible use would the solution of such questions be to the large mass of men and women in after life we cannot see. Not only in this, but many other ways are useless things given. A physician for whom we were working not long since, whose daughter was being educated at a popular institution, told us his daughter came home in a dilemma because she had a composition to write on "Anacreon." He said, "She came to me and asked me to help her. I said to her, 'Did your teacher give you a composition on Anacreon to write?' 'Yes, papa.' 'Do you know anything of the life or history of your patron saint?' 'No, papa.' 'Well, I will help you if you promise to write and give the composition to your teacher.' 'I will, papa.' 'Then write 'Anacreon was a dirty, nasty, filthy poet of ancient times, and papa says the less I know of him the better for me.'"

It is not very long since that we read an article bearing on this point. It was the testimony of a dentist. He stated that a young girl was brought him for dental service, but after the most careful examination he could only find two or three small cavities in her teeth to fill. The

young girl was sent to school and eighteen months later she was brought him again. He was astonished to find in this comparatively short space of time the teeth in the most deplorable condition. On making inquiry of the mother, he found that the girl was during this interval constantly and uninterruptedly engaged in innumerable studies; that morning, noon and frequently late into the night she was thus engaged, being of a very ambitious nature. He attributed the excessive decay he found in this case to no other cause than severe mental application, without a commensurate physical offset.

Some time about Christmas we clipped the following from the *Public Ledger:* "A CHILD DYING FROM OVERWORK AT SCHOOL.—At the Bacup Town Council meeting yesterday Dr. Brown, the medical officer, said it had been reported to him that a girl aged seven had died during the month from inflammation of the brain, brought about by overwork at school. The medical officer strongly condemned the practice of making young children do home lessons at night. He said it worried them and made them restless in their sleep. Education, he said, was often pushed to such an extent nowadays that childhood was robbed of all its happiness and joyousness. It tended to physical and mental deterioration, and children were often ruined. This was the first case of the kind that had ended fatally since he came into the district six years ago. The doctor was of opinion that the subject ought to have the attention of the school boards throughout the country, and parents ought to take the matter into their serious consideration."

A colored girl of Paterson, N. J., won high honors in the public schools and recently passed successfully an examination for teachers in Brooklyn, but the strain was too much for her, and in a short time she died of brain fever. Such results are, unfortunately, too frequent. Not a few pupils of the public schools suffer from over-study, though not always to the same degree. The Chinese, who are wiser than we are in some things, hold that the first business of educators is to teach the young folks how to live—morally and physically. These are two branches of education that occupy much less of the time of our schools than their importance demands. The cramming process runs directly counter to healthful living.

We heard of a rich gentleman of this city who had a bright, promising daughter. The fond father, proud of his idol's proficiency, urged her on in her studies, and in his vanity to see her shine left her no time for recreation. The living and dead languages were alike familiar to her, while she was a brilliant performer on the piano and a rare vocalist. But alas! she had hardly reached her twenty-second year before her constitution broke down under this mental strain and she was claimed by death from her deluded and broken-hearted father. Let me ask if such

things are warrantable, if such things should continue? Outside of the decay of the teeth, is all our love, all our aspirations, all the hopes of happiness we have for our loved ones for the future to be set at naught for this useless and baneful cramming of our children in studies which, more often than otherwise, will be of no manner of use to them in after life? Why, gentlemen, we would not overwork our horses and dogs as we do our children. We rear up our children to be our pride, and we have them taught accomplishments that they in their turn may have happiness in their households; but can there be happiness in any household when the heads of such are weak, delicate and sickly? Let us beware of this forcing and stop in time lest our "pride may have its fall," like the example I have related—not alone a fall, but that we may, by this pride, throw on the world beings, both male and female, utterly incapable of the functions of either man or woman.

Who of us, walking along our thoroughfares, but has noticed the general forms of our young girls as they walk before us? Look at this one's waist—we can span it with one hand. See how that one walks, as if her joints were held together by vibrating spiral springs instead of strong muscles and sinews. Behold the curved shoulders of this one, the chicken-breast of that, the narrow back of the other. Meet still another with whom, perhaps, you may be acquainted, and take her hand in your friendly grasp; you hold a collection of cartilages (not bones) interlaced with softer muscles and covered by still softer skin. Her eyes may be bright, but perhaps they glisten through the action of belladonna: her cheeks may be rosy, but it is more probably due to cosmetics than to active capillary circulation; her bust may be full and round, but artistic padding may give the appearance of excessive development of the *pectoralis major*. With all the aids of art she cannot disguise her general weakness, her incapacity to endure fatigue of any kind. This is the girl of the period. As you leave her, you make your reflections. Tom, your son, who is a strong lad, given to all athletic sports, and is not so bright at book-learning as you might wish, is partial to this girl, but will she make Tom a good wife? Can she bear children for Tom so that he may have the happiness to see a growing family of strong, healthy boys and girls? You have your misgivings, and fear that though she may shine in society, though she may sing, dance, converse well, or perform brilliantly on some musical instrument, her physical duties as a mother would be seriously lacking.

We do not, in this, wish it to be inferred that we are unfriendly to education; far from it. There can be no one who is more keenly alive to the fascinations of study or the pleasures which scientific investigations impart; but we do hold that the system of education or cramming, such as is pursued at the present day, is baneful in its effects and has a

most deleterious influence on the health of the growing community. Children are sent too young to school, before their bodies are sufficiently developed, and unless a change is made in the course of study, and a stop put to the multiplicity of mental duties imposed on children whose bodies are not sufficiently developed to stand the mental strain imposed on them, we can only look in the future for a fearful death rate among the progeny of the young girls and boys now growing to manhood and womanhood and taking unto themselves the cares of a household and the rearing of a family.

We believe in the old-time schools, where boys and girls went in simple, strong clothing that would stand the wear and tear of a healthy romp; where not more than twenty to twenty-five pupils constituted the whole strength of the school; where reading correctly and with proper accent and modulation was taught, together with correct spelling, geography, history and arithmetic. This course saw our grandparents through the world, with strong, well-developed and vigorous progeny. In later life, should the inclination, taste or talent of your child develop a predilection for languages, music, drawing, painting—or, indeed, any of these accomplishments which go so far to foster the beautiful and add to the pleasures of home—we would be the first to recommend that every effort be made to give to their children every advantage for the acquisition of one or as many of these as their capacity would prove them capable of.

An "Old Beau," writing to *The Press*, gives an account of society in his day—some fifty or sixty years ago: "Then among the ladies who rivaled Mrs. Rush there were Mrs. Wallace, Horace Binney's sister; Mrs. Tom Willing, Mrs. Rawle, Mrs. Kuhn, Mrs. Cadwalader, Mrs. John Butters and Mrs. Vaux. All those ladies were famous for their hospitality and graces of person. How well I remember Mrs. Vaux when she heard of her son Dick dancing with Queen Victoria. She could hardly withhold her maternal pride and exultation. 'They do say that our Richie will marry the Queen,' was her confidential communication to a little crowd of intimate gossips who were taking tea with her. Ah, me! how the lights of memory flicker through the misty lapse of time. Some few weeks ago I was in the Ridgeway Library gazing through the glass screens at the Rush Memorial Room. I soon filled the apartment with once familiar forms and faces—some living, some dead. On the centre ottoman of blue silk it was not difficult to picture Mrs. Rush, attired in the gray silken robes and rich lace she so much affected. By her side her always intimate friend, Miss Ritchie. Surrounding them groups of both sexes—Dr. Horner, the University professor of anatomy; Mrs. Marcoe, Mrs. General Harrison (whose house used to be opposite *The Press* office), Mrs. Tilghman, Nicholas Biddle, Ole Bull, the stately

form of King Joseph Bonaparte, Captain Marryat, Miss Adeline Thompson (a bud of a maiden), with Dickerson Eyre hovering near her. Then Colonel Drayton, of South Carolina, must be added to the company, and Pierce Butler and his brother John; Mrs. Bayard, a daughter of Carroll of Carrollton, old General Pleasanton, George Chapman of the Navy, Colonel Roach and his gay troopers, Stephen Fotteral and a host of others. Where are many of them now? I really think there was a far better tone in society when Mrs. Rush was queen. The offensive young puppy who is present everywhere now, because he can waltz was an almost unknown entity. Stately quadrilles and the invigorating polka were joined in by young and old. Girls in society were brought up to be housewives, and were far more likely to discuss domestic than political economy. I do not remember a single young woman of my days who knew either Greek or Latin, or who had the slightest predilection for algebra. Fashionable people, also, got up early, dined early and went to bed early. They did not care for French cooking, nor was much attempt made at ostentation."

Our idea is to first secure a good healthy organization by letting children have plenty of play and exercise, and not bother them with study of any kind until they are ten or twelve years old. With this good foundation the superstructure of mental acquirements will be accomplished with one-half the exertion, expense or drain than if attempted on a poor, weak foundation or immatured physical development. In support of this we will state that a lady of our acquaintance, who had had many years' experience as a teacher, told us that at one time she had under her care a little girl of *three years of age* who could read fluently. This child remained under her tutelage until she was sixteen years of age. When this child was thirteen years old she received from the country a vigorous girl who was also thirteen years old. This girl did not know her alphabet, and was as ignorant as she well could be of all book learning, yet she assured me that when both these girls were sixteen years old one was no farther advanced than the other. The one that she had had for thirteen long years had grown weary and surfeited with study, while the other, who was vigorous in body and consequently vigorous in mind, had grasped, intuitively, *in three years*, what the other had taken thirteen years to acquire.

There is not, therefore, a doubt in our mind that this excessive mental exertion, imposed now-a-days on children, is hurtful to the general health, and if hurtful to the general health, it must be, as a sequence, hurtful to the teeth. If this should prove to be one of the proximate causes of dental decay, and we are impressed it is, or that it contributes largely to it, why then we as specialists, seeking to preserve or improve the condition of the dental apparatus, have the remedy in our

hands and should do all in our power to prevent parents from sending their children so early to school. Let us advise them against this early mental exertion; let us impress on them the advantages of physical training first, and mental training after.

Running now-a-days is voted by nearly all parents as rude and boorish, and even boys have been so schooled against it that they, too, consider that they would be lacking in good breeding if they ran or raced along the streets to or from school. The constant, almost stereotyped admonition of mothers to their boys and girls when sent to school or on an errand is, "Don't run; walk like a gentleman or lady." So it is that every prompting of nature, every impulse for health is checked or controlled by the modern system of education, culture or politeness, and these checks must result banefully to the general health. It is really strange that we should do all we can to check the promptings of nature and make our children unlearn what is so calculated to make them hearty, robust and strong.

We can well remember in our boyhood how constantly we ran to or from school—in fact we rarely walked, and we attained a speed that few of our companions could equal, and we have no recollection of either of our parents advising against it. We can remember, too, how, after a race, we could distinctly hear our heart thumping within the thorax and sending the pure blood teeming with life, health and vigor through the minutest capillary.

Let us, then, for our dear ones' sake, for the sake of humanity, for the sake of those we serve, try to bring about a change that may ameliorate if it does not eradicate disease, by speaking and advising against this useless and injurious cramming of our children before their bodies are strong enough to bear the strain on their minds. Then will the science of dentistry become apparent; then will we arrest decay by nature's remedy, and more effectually than by the vain effort of filling and refilling teeth with gold, amalgam or plastics of any kind. We need not fear that the reformation will be accomplished in our generation, or even could such a happy result be brought about that "Othello's occupation would be gone." The world prospered in the remote past with no dentists and few physicians, and yet all men found occupation; and as it was in the past so will it be in the future. Let us, then, do all we can in the interest of humanity to this end.

It may be thought in the points we have advanced on this subject that we have taken an extreme view of the situation, or that we spread needless alarm, or that even the abuses we have spoken of do not exist in fact, but we reply that though they may be thought extreme we feel warranted in putting the case in its most heightened coloring to stir up a counter current with the hope of amelioration. Can any gentleman

deny that dental decay is on the increase rather than the reverse? Cannot every gentleman in our specialty testify that we rarely now find those strong, dense, flinty, well-formed teeth that were the rule with the generation which is now rapidly passing away? Do we not find, rather, that the types of the teeth are changing; that molars are becoming more multicuspid and that fissures in these and in the bicuspids are more numerous; cuspids not so large or so prominent, and incisors, and, indeed, all the teeth flatter at their proximate surfaces, offering broader and larger surfaces of contact, and thus being more liable to decay from the facility with which particles of food are held in contact next those surfaces? If these queries are acceded to, (and we doubt not their affirmation with all observant men), then we hold that our views are not severe; that our alarm is not excessive, and that the abuses of the false system of education to which we partly attribute them are not extreme, and do not exist only in our own imagination.

Discussion.

Dr. Darby. Dr. Chupein's paper is a very interesting one and shows that a great deal of thought has been given to the subject. It deserves a wider circulation than in the dental journals. The cramming process spoken of can but be deleterious to children. Many children are overworked in school, but my observation has led me to believe that it is more frequently with girls than boys. Most boys are lazy in the matter of study and much prefer play. Children in the schools of Germany and France work more hours than in our American schools.

An overworked brain at an early period in life must of necessity tell upon the physical condition of the child, and may, in a measure, show itself in defective nutrition to the teeth. I cannot, however, believe that the school system of America accounts for the great amount of dental disease at the present day.

Dr. James Truman. It is not, as a rule, that the dull scholars are injured by overstudy at school. This result is usually confined to those naturally gifted with good memories and quick perceptions. They are the ones that are crammed to their injury. The lack of system in this country in education is to be deplored. Outside of the public schools there is no system other than that confined to each school, and the result will be according to the ability of the teacher to formulate this into orderly arrangement. What we need here, in my judgment, is a head, and that head should be at the seat of government, either at the capital of each state or at Washington. The public schools should be feeders to one university for each state, and the studies so arranged with the classes that there would be no difficulty in a pupil going from one school to another, and that their studies should be for the benefit largely of the dull scholar and not for the cramming of the bright ones. This is

briefly the system now in vogue in Germany, and while it would not be practical in all its details here, it remains the most perfect system of education known. Until something of this kind is adopted the best results cannot be attained.

There is no question but that the nervous tendency of our climate, superadded to exhausting school labor, is undermining the health of thousands of children, and the teeth must necessarily sympathize in the general deterioration. Parents should watch their children and take them from school and study at the first appearance of loss of energy. Nothing is lost by this but very much gained. The boy and girl may not graduate at eighteen but they will at twenty, and without physical or mental loss.

In my judgment, teachers should understand that they are in school to teach, and that instruction is not to be given by the parents at home but in the school-room. This remark applies not only to general teaching, but is equally applicable to our profession, to colleges, dental and medical.

INCIDENTS OF PRACTICE.

Dr. Darby. I have seen to-day an interesting case of retarded second dentition. A girl sixteen years of age, who has not lost her temporary cuspids and molars. As yet there is no appearance of the permanent cuspids or bicuspids. Shall I remove the temporary ones or wait until there is some indication of the development and eruption of their successors?

Dr. Guilford. There is danger in that practice. There is objection to removing a deciduous lateral incisor. The permanent one may never have been formed and may never come through.

Dr. Tees. In cases of tardy shedding of the temporary molars, it has been my practice to extract the uppers on one side first, and after the erruption of the bicuspids then the lower ones. When the lower bicuspids are erupted, to pursue the same course on the other side.

The annual meeting was held Saturday evening, May 3d, 1884, at the office of Dr. S. H. Guilford, 4006 Chestnut street, President Truman in the chair.

The following officers were elected to serve during the ensuing year:

President—S. H. GUILFORD.

Vice President—E. T. DARBY.

Recording Secretary—AMBLER TEES.

Corresponding Secretary—H. K. LEECH.

Treasurer—E. H. NEALL.

Librarian—W. G. A. BONWILL.

Executive Committee—E. C. KIRK, LOUIS JACK, T. F. CHUPEIN.

The regular meeting was held Saturday evening, June 6, 1884, at the office of Dr. Darby, No. 1513 Walnut street, President Guilford in the chair.

INCIDENTS OF PRACTICE.

Dr. James Truman. The majority of those present have without doubt seen some account of the so-called new method of filling teeth introduced by Dr. W. Herbst, of Bremen, Germany. It has created quite a sensation in German professional circles, he having given clinics in Berlin and other places to demonstrate the method. I have been experimenting for some time with this mode, in the mouth as well as out of it, having had instruments made from the cuts of Dr. Herbst. The first results were quite favorable, and led me to hope that I might be able to offer something valuable to-night, but I regret to have to say that more thorough experiment did not sustain the first impressions. We are all well aware that laying one sheet of cohesive foil upon another produces a union; and by the aid of a burnisher this may be continued to the filling of a cavity. This mode was not a success. We do not know, as far as I am aware, in what the cohesion of gold really consists. The long serrated points and the short serrated points have each their advocates, without any very satisfactory reason why one should be preferred over the other. In extended examinations made several years ago of various forms of gold, I was unable to discover by microscopic evidence that it was owing to any peculiar condition of the surface. We all know that freshly-prepared gold will cohere, but as we proceed with the filling this property alone cannot be depended on. Hence the failure by the use of the burnisher or polished gold or ivory points. The idea of Dr. Herbst is to run a smooth-pointed instrument, by the aid of the dental engine, pressing the gold in place piece by piece. This part of the process I regard as new, or at least I am not aware that it has been used before. My experiments were principally made out of the mouth, in natural teeth mounted for the purpose. The first attempts at cohesion were apparently satisfactory, but the test of solidity gave very poor results,—in fact, every effort to make a filling as we understand it was a failure. The cohesion is not perfect, and I doubt whether it is possible to make it so. Still, I would not condemn it on a few experiments. It should be fairly tested, as it may have a value not as yet perceptible. In the filling I present, prepared to-day, I made use of Quarter-century

gold. You will observe that it has no density, and, not having that, it finishes poorly. It is possible to find a use for this process in cavities with strong walls, and where contouring is necessary. This subject will undoubtedly come up for discussion in our conventions this summer, and it seems to me, therefore, important that we should approach its consideration intelligently. In order that Dr. Herbst may be better understood, I quote from a report of clinics given by him (Poliklinik of Prof. Busch, of Berlin, on the 14th, 15th, and 16th of February, 1884): "The instruments should not be polished on the points, but made quite smooth. They should be of various sizes. * * * If these become too cohesive (magnetic), I place them under rapid rotation, on a piece of tin. This will have to be repeated from time to time. * * * In filling, I commence by passing a piece of watch-spring between the teeth, which must reach the gum and the border, and not quite to the grinding surface; otherwise the entrance to the cavity will be too contracted. I now take a steel needle (darning or sewing needle) or tooth-pick, but prefer the needle, as it takes up less space; this I press closely between the steel spring and the adjoining tooth, breaking off the extending portion." To aid in holding the watch-spring in place, he fills the opposite cavity, if there be one, with shellac, being very careful not to have it too hot. This covers the process, the rest of the report being made up of operations performed, giving the amount of time required for each insertion. It is very questionable whether this plan of filling teeth will ever be adopted in this country in packing gold, but I am satisfied it will be found very useful with amalgam, having tried it here with a great deal of satisfaction.

Dr. E. C. Kirk. I have never tried the method, but it seems to me that there is one mechanical difficulty in the way, and that is that you are obliged to use instruments which are necessarily straight; otherwise you cannot place them in the engine, and all teeth cannot be filled with instruments which are perfectly straight. Nearly all of our instruments are curved or bent.

Dr. Guilford. There are two or three objections, and one is that these points necessarily press in all directions.

Dr. Kirk. I do not see how they can press cohesive gold in all directions. That is one of the difficulties in working with cohesive gold; it cannot be consolidated by lateral pressure—only by direct.

Dr. Guilford. This point, when pressed down, presses in all directions. He does not pretend to fill a cavity except within circumscribed walls, unless he puts an artificial wall there, formed by a matrix.

Dr. Leech. If the tooth stood alone, then he could not fill it. What are the special advantages claimed for this mode of filling?

Dr. Jas. Truman. He claims that it will do in fifteen minutes that which would take an hour by the ordinary mode. I do not question that it can be done, but the point is whether the filling will be good for anything after it is done. I have not been able, by any experiments which I have made, to secure any solidity.

Dr. Leech. It seems to me that, as he has to go to the trouble of making a matrix filling out of it by the use of an old piece of steel, it has no advantage over the old way.

Dr. Register. I think it would be impossible to get a filling that would be solid with a smooth instrument from rotary motion. At the same time, I think that with a smooth-pointed instrument and the use of No. 60 rolled gold a perfect filling can be made with a smooth point, using the blow of the mallet.

Dr. Truman. I cannot understand how you can make a solid filling. It may appear to be solid, but is it?

Dr. Register. I have had them to curl out, like a piece of solid metal, from the result of mastication, and I have cut them down with an ordinary cavity burr.

Dr. Truman. Of course the matter is to be still further tested. This is only preliminary. What I wanted was to bring the matter up and let each member test it for himself. Anybody can do that very easily.

Dr. Register. I believe it takes a very much lighter blow to make gold cohesive than is supposed.

Dr. Guilford. It depends upon the thickness of the gold.

Dr. Register. Of course it does, and its physical nature must be considered.

Dr. Truman. There is one thing which may be said about filling teeth out of the mouth. As far as my observation goes, it is a particularly difficult thing to make a good filling in an old tooth outside of the mouth, on account of its brittleness. It is much easier to make a good filling in the mouth.

Dr. Darby. It seems to me that, if I were to use a burnisher for packing gold, I should prefer a corrugated one. A little irregularity of the surface would be apt to give a better result than a perfectly smooth or even one. I made use of an old burr, first grinding off the teeth, and then smoothing it upon my oil-stone, and, although I could pack gold with it, the result was not satisfactory. I question whether there is anything in this new method that will be of any value to us in America, since our method of working gold is so unlike that just described.

Dr. Register. Does Dr. Truman think the dentists of Germany have reached the perfection of filling with gold that we have?

Dr. Truman. The German dentists are not all alike, though the

majority I think are not up to our standard. There are many very good operators, and the number is increasing annually. Dr. Herbst used a gold made in Bremen similar to Williams's gold.

Dr. Guilford. Did he state how thick he used the gold, or in what way he prepared it?

Dr. Truman. I am not aware that he regarded that as of much importance.

Dr. Guilford. Dr. Geo. Herbst, the brother of the man who invented this method, showed me a number of appliances for operating, while in this country, and they proved that both he and his brother were very ingenious men. I appreciate their ingenuity; but, at the same time, I cannot see anything in this method which will benefit us in any way.

Dr. Chupein. I would like to ask if any of the gentlemen present have tried the bichloride of mercury for the treatment of pulpless teeth. It is claimed that if very weak it will destroy all kinds of bacteria, and Dr. Abbott, of New York, maintains that the cause of trouble always in all these pulpless teeth, when we come to fill them, is the presence of bacteria, and that by cleaning them we destroy the bacteria that are in the roots. Now, if the bichloride of mercury will destroy bacteria, it strikes me it ought to be a good thing for the treatment of teeth which are pulpless.

Dr. Guilford. There does not seem to be any response. It seems that none of the gentlemen present have experimented in that direction. Has any gentleman tried Dr. Kirk's suggestion as to sodium carbonate? I tried it, and it succeeded very well for a few days; but the patient took sick and did not return as soon as she should. When she did return the tooth was again sore.

Dr. Kirk. I am still using it, and using it successfully, particularly in the treatment of sensitive dentine. It has been my practice to partially dry out the cavity and introduce a small particle of the sodium carbonate, leaving it there for a few moments, and then to remove it, after which I find I can proceed with the preparation of the cavity without any considerable pain to the patient—a result much to be desired in the treatment of the teeth of children and delicate nervous patients.

Dr. Guilford. Without the rubber-dam?

Dr. Kirk. With the rubber-dam.

Dr. Darby. I have just had some pleasing results from the use of permanganate of potash. The case was that of a central incisor which had been filled by another with a plastic filling. After removing the filling, with the intention of substituting gold, I found the pulp was devitalized, and the pulp canal filled with the most offensive putrescent pulp-tissue. The odor was digustingly stenchful.

After removing this matter as best I could, I made a fresh solution of the permanganate (in color about like claret wine), and then wiped the canal thoroughly with this, using it time and again until I felt that I had made thorough work with it. Then, putting a dressing of the same solution in the canal and closing the cavity of decay with gutta-percha, I sent the patient away with instructions to return in case pain followed. She did not return, as I had feared she might. At a subsequent sitting, a few days later, I repeated the application, and with the exception of a slight soreness there was no trouble. When I saw her the third time the cotton removed from the canal had no disagreeable odor, and at the next sitting I shall fill the tooth. I feel confident that if I had used creasote or any other of the antiseptics or disinfectants formerly in use, I should have had trouble; for it is in just such cases as these, where the pulp canal is filled with liquid or semi-liquid putrescent matter, that we look for trouble if the tooth be closed.

Dr. Guilford. Was there any soreness at the root of the tooth?

Dr. Darby. There was some little soreness there; but she told me it passed away under this simple application.

Dr. Tees. Under ordinary circumstances, do you think there would have been soreness from closing up the pulp cavity?

Dr. Darby. I should have expected it under the old mode of treatment in at least nine cases out of ten.

Dr. Tees. I have tried Dr. Kirk's method of using the sodium carbonate, and I found difficulty in using the fine crystals. I would like to ask him if it would not be better to use it in solution?

Dr. Kirk. I have found it convenient to keep a box of crystals at hand, but a solution can be made at any time. Used in that way it would be taken up by capillary attraction. But I do not think the solution would be as efficient. While I am up I would like to say a word in favor of permanganate of potash. We all have those disagreeable cases, that come to us from time to time, of people who have never known the use of a tooth-brush, or cleansed the teeth in any manner, rendering it almost impossible to operate for them, owing to the offensive odor of the breath. In such cases I always make a dilute solution of the permanganate and direct the patient to rinse the mouth two or three times, after which the objectionable odor of the breath entirely disappears. In regard to Dr. Darby's treatment of the tooth of which he has spoken, I would like to ask him if he found any discoloration on the inside of the tooth-walls resulting from the permanganate?

Dr. Darby. I did not.

Dr. Guilford. I would like to ask whether any of the gentlemen have found any number of cases in which the tooth became discolored

from the use of it? I have noticed that in some of the dicussions in New York it is said that a permanganate solution will discolor a tooth.

Dr. Kirk. It can be readily removed by the use of oxalic acid.

Dr. Darby. In speaking of the disagreeable odor, I may say that I have used the permanganate in the same way, and I have also found a remedy in "listerine." We all know how the odor of tobacco smoke remains in the mouth. I had a patient come to me a few days ago to have his teeth operated upon, and his breath was very heavy with the odor of smoke. I took some of this listerine, put it in a glass of water, and gave it to him to use as a mouth-wash. He did so, and it entirely removed the odor of the tobacco smoke. It is one of the best things to take the odor of smoke out of the mouth that I know of.

Dr. Register. In regard to listerine, I may say that I made use of it on one occasion, after removing tartar from a loose tooth. There was one of the teeth in particular which was very loose, on which I used it while removing the tarter. The gentleman on whom I operated, who was a physician, brought the listerine to my notice, and said he used it in the family as a mouth-wash. Some two or three days afterwards he came into my office and showed me the tooth, and really it was quite firm it its socket. All the looseness had disappeared. Whether it was from the removal of the tartar or from the effects of the listerine, I cannot say. I have made considerable use of a preparation called Dobble's solution, which is an article favorably spoken of by specialists in their treatment of diseases of the nose and throat and troubles of that kind. In cases of pyorrhea alveolaris, after using mineral acids, I have had my patients supply themselves with Dobble's solution, and with a syringe force it down into the pockets around the teeth, and I have had some very satisfactory results from it. To-day teeth that I thought were almost worthless are comfortable and useful in the mouth, after perhaps two years' use of this article,—the patients being careful to have the tartar taken off the teeth every three or four months.

Dr. Guilford. What is that solution composed of?

Dr. Register. I cannot tell you positively; but I think it is composed of carbolic acid and soda.

Dr. Kirk. I would like to ask Dr. Darby what has been his experience with the use of listerine?

Dr. Darby. I have used it as a mouth-wash, and as a disinfectant, and in cases of pyorrhea alveolaris.

Dr. Kirk. Have you ever used it in cases of pulpitis?

Dr. Darby. No, but I am of the opinion that it would be a good dressing for that purpose.

Dr. Jefferis. I have used it in a number of cases; but I was disappointed in it. I have, however, had very good results from the use of boracic acid in cases of pulpitis. I would like the gentlemen to get some, and try it by packing it in the teeth.

Dr. Kirk. I believe boracic acid is one of the constituents of listerine.

Dr. Guilford. The odor reminds me of eucalyptus more than of anything else.

Dr. Truman. The predominant taste is that of thymol. I have used it to some extent; think it is very valuable as a mouth-wash. It appears to me to be more valuable for that than it is for the treatment of diseases of the pulp.

Dr. Guilford. It is slightly flavored with wintergreen.

Dr. Truman. I think that in abandoning thymol we lost sight of one of the most valuable agents. To my mind it is one of the best constituents for a mouth-wash we have.

Dr. Tees. During the winter I had a stubborn case, it being a superior molar, in which I tried sodium carbonate. I had prevented any severe effects by the use of coal-tar creasote, chloroform, and alcohol, and giving vent for a week or two at a time, so that there was just a slight but continued inflammation. It annoyed the patient occasionally, but did not keep her awake at night. About that time I saw Dr. Kirk's article in the DENTAL COSMOS on sodium carbonate, and I gave it a trial. I made an application of it, and the patient reported at the next sitting that it pained her very severely for several hours afterwards, but that since then it had not troubled her any. I then removed it and applied creasote, and sealed it with oxychloride. Since that time, about four months ago, there has been no trouble with the tooth. In this instance I was successful, although I was discouraged from using it in other cases, on account of not being able to force the crystals into the proper place.

Dr. Truman. I am gratified to hear Dr. Kirk indorse the use of an alkali in sensitive teeth. I have been trying to enforce this idea for the last ten or fifteen years, with only moderate success. It is the true direction to look for good results. I have always used the bicarbonate of soda.

Dr. Register. Can any one tell me the active principle of "Näbolï?" I provided myself with a box of this medicine when it was first introduced, and I must say that it gave me the best results that I ever secured from anything of the kind. Where teeth are very sensitive at the necks, where we have recession of the gums, and where they become very sensitive, I have always found them to yield to the treatment of Näbolï.

Dr. Guilford. Tannic acid is the active principle. It is tannic

acid and glycerin for the first three numbers in different proportions, and the fourth is chloroform. It is the tannic acid that does the work. Number one is weak; number two is stronger; number three is stronger still, and contains the greatest amount of tannin; while number four is a wash something like chloroform.

Dr. Darby. My experience with it is that patients complain bitterly that it causes a great deal of pain. It has done good, but it has caused pain.

Dr. Tees. In regard to the use of medicines about which we know nothing, I advocate them to a certain extent. The lives of three of my children were saved by means of proprietary remedies. Dr. Register uses Näbolï because it gives relief, and he is justified in using it for that reason. I think we are very foolish and inhuman if we do not use them when other remedies fail, and they produce good results.

Dr. Register. I do not wish to create the impression that I use Näbolï in a reckless manner, because I do not. When I first got it I used it very carefully, and was also very careful to examine the condition of the tooth afterward. I found no bad effects from its use, but, on the contrary, good results, and so I came to use it very generally.

Dr. Kirk. I desire to report some tests I have been making in the conditions we frequently see in the mouths of patients wearing vulcanite plates, which we term "rubber sore mouth." Some time ago I examined the mouth of a lady who was wearing a rubber plate which had been repaired, and had therefore been subjected to two vulcanizations. The surface of the newly added rubber was everywhere corroded or roughened, apparently by some active solvent, while the surface of the original plate was hard and polished. The tissues in contact with the plate were red and highly inflamed, but the inflammation corresponded almost exactly in shape and extent with that portion of the rubber plate which had been recently added, and, therefore, vulcanized but once, and perhaps imperfectly. On testing the reaction of the inflamed mucous membrane, and likewise that of the mucus adhering to the upper surface of the plate, I found both distinctly alkaline—I might say strongly so. Since then I have tested at least half a dozen rubber sore mouths, and in each instance the reaction has been markedly alkaline. In all cases that I have examined, where the mucous membrane was pink and healthy under vulcanite plates, I have found the secretion to be neutral or slightly acid. Our positive knowledge as to the etiology of this troublesome condition is very meagre. It has often been attributed to the vermilion used as coloring matter in red rubber; yet we know that vermilion is insoluble. There is nothing, so far as I can ascer-

tain, that will dissolve it which will represent a solution of mercuric sulphide, and it is only decomposable by a very high temperature or a strong mineral acid. More than that, every particle of it in a vulcanized plate is enveloped in a film of vulcanite, which would clearly protect it from contact with the oral secretions. It has been asserted that the temperature of vulcanization is sufficient to effect the decomposition of the vermilion, and the injurious results are produced by the presence of the free mercury in the finished plate; yet this would seem to be theoretically impossible, at least, from the fact that a large excess of sulphur is added to the mass along with the vermilion, the contact of which would immediately re-convert any free mercury into mercuric sulphide during the process of hardening. It has also been suggested that the sulphur entering so largely into the composition of vulcanizable rubber was a factor in the production of rubber sore mouth, and that sulphur is soluble to a certain extent in alkalies; but this would hardly seem plausible in view of the slight medicinal activity of sulphur, even admitting that a large percentage of that introduced in rubber exists uncombined, which excess exerts only a mechanical effect on the mass. I have brought this subject up in order to learn if any of the gentlemen present have tested the reaction of the secretions in cases of rubber sore mouth. It would certainly be an interesting fact if this inflammatory action was found to occur only in connection with an alkaline condition of the oral secretions. My own experience, in the few cases I have tested, has shown this to be the case without exception. While we all admit that the non-conductivity of rubber plates is frequently a source of irritation, yet there is much evidence to show that this quality of vulcanite does not account for all of the irritative influence it seems to exert in many cases.

Dr. Darby. I have seen two remarkable cases of sore lips and face,—one of a lady who came to me perhaps a year ago. I was filling some teeth for her, using the rubber-dam, with a napkin laid under it. The next day, or a day or two later, she came back with almost the worst-looking face I ever saw. It looked as if it had been blistered, and she said her physician told her that I had poisoned it by the use of something. I concluded, of course, that the saliva might have been acid; or that, lying in contact with it for a considerable time and excluded from the air, it produced these blisters. A few days ago a young man came to me upon whose teeth I was operating, using the rubber-dam. When he came back, a few days later, to have a wedge put in for another sitting, he said, "Doctor, I had an awful face after I was here. It was all a mass of blisters." I wondered whether there was anything in the rubber that could have produced it. I presume there was not. I merely mention it

to see if any of the other members present have had a similar experience.

Dr. Guilford. What kind of rubber was it?

Dr. Darby. In the last case mentioned it was the new white rubber. In the first case it was the ordinary rubber, such as has been in use for years.

Dr. Leech. A lady from Chicago cautioned me to wash the rubber a second time before using it, because every time it was used without this care she got "fever blisters," as she called them; and I always gave it an extra washing before applying it. I never had any trouble, because I took this extra precaution. I was always careful to use a coarse napkin upon the face, so that the rubber would not touch it any more than was necessary.

Dr. Darby. My theory is that it was the acid of the saliva, or some abnormal condition of it, that caused the trouble.

Dr. Register. I operated upon a lady who came to me some days afterward with her lower lip in a very deplorable condition. It was a mass of blisters from one end to the other. I asked her what was the cause of the trouble, and she said she did not know, unless I had caused it. She said she had applied an ointment, and I thought that perhaps the trouble was caused by its use.

Dr. Tees. I lost a patient some two or three years ago in that way. There was a breaking out of pimples all over the parts covered by the dam, a day or two after the operation. I really could not believe it due to the rubber, because I had used it so much for many years, and had never had any such results before. I ascribed it to impurities of the blood. He told his mother he was not going to that dentist any more. So he went to another, who filled cavities with oxyphosphate, napkins being used. He came back a few months ago, and I said, "Sammy, I will use the rubber-dam again. You are a different man now,—your blood is pure." I saw him a week or two afterwards, but there were no after effects in that case.

Dr. Dixon. It seems to me it could not be due to the rubber, because I had that experience long before it came into use, and I think Professor Darby says he used the napkin between the rubber and lips in the case to which he refers.

Dr. Guilford. I have noticed, in cases of my own, that it generally occurred in hot weather, and I always use a napkin under it.

Dr. Register. A rubber-dam makes a most excellent blister. I have used it on a horse with a lame leg, by binding it on the knee, and in twelve hours it raised plenty of blisters, by simply excluding the air.

Dr. F. M. Dixon. The subject I broached at the last meeting I had intended to have written out, and to have read the paper at this

meeting. However, I have not been able to do so, although I have the same memoranda, from which, as the hour is late, I will read such parts as describe the case, and probably that will be all that will be necessary: "Mr. J. S., a minister of one of our churches, came to me in 1868, to have a partial set of teeth—the four superior bicuspids, cuspids, and incisors—on a silver plate, the natural molars being *in situ*. The plate was made as usual, clasping the natural molars. This was worn for a year, at least, when a niece of the patient called at my office and stated that her uncle wished to see me, as he had had a fit, and they supposed had swallowed his teeth. I found two incisions, one on each side of the esophagus, extending as far down as I could see, such as the edge of the plate would make, which satisfied me that the teeth had gone down. The patient was a large, muscular man. I took the impression of his mouth and made a second set. Now for the sequel. I was in my office just nine days after the second set was made, when the door opened and in walked my patient, holding in his hand the first set of teeth. Of course, my first question was: 'Where did you find them?' supposing that he had put them down somewhere and had just discovered them; but he replied that he was washing his face a few minutes before, and while bending over the basin something moved in his throat, which produced nausea, and out dropped the teeth." I first thought of making this statement rather from the singularity of the circumstances than otherwise; but it occurred to me that it illustrated very markedly the danger patients are subjected to by the careless adaptation of plates; and I thought it well enough to call attention to that fact, that by knowing of the danger to which we are liable measures may be taken to prevent them.

Dr. Darby. May I ask the name of the patient? I think I have heard of it before, and that I remember the circumstances.

Dr. Dixon. The gentleman was a clergyman of Frankfort.

Dr. Truman. At the last meeting I spoke of the article of Jul. Parreidt (*Vierteljahrsschrift für Zahnheilkunde*), in which he gives sixty-two cases of swallowing teeth, and of the effects in connection with them. Of course, it is too detailed to read here, nor would it be necessary to go over the whole matter; but the subject is to me one of great interest, for I do not think we pay sufficient attention to the matter of inserting artificial teeth. Dr. Parreidt sums up these sixty-two cases by saying that twenty were swallowed in sleep; in spasms, six; three in the night; in eating, five; drinking, two; taking of a pill, two; by a dream, or through a dream, two; fainting, one. Six of those resulted in death. There is one case where he speaks of a man living for twelve months with a set of teeth under his tongue, which he cannot explain; but it is

not disputed to be a fact. We all know how teeth will get coated with tartar, and remain so for years. The different positions which these plates have occupied after being swallowed, and finally thrown out in ordinary processes, is rather remarkable. It is only astonishing to me that some of the large-sized plates, the cases of which he reports, could go into the stomach at all. One remarkable fact is, that a large proportion of them were metal plates. His idea, in summing up the matter, is that plates and clamps, perfectly smooth, will pass into the stomach and out without any trouble, and not produce death; but if they have jagged edges, where the clamp has been broken, it is almost certain to end disastrously. We had a case here reported in the papers a few days ago where the individual swallowed a partial set, but I know nothing as to the result.

Dr. Dixon. It may be well to add that the case to which I have called the attention of the society is reported by Dr. William Dixon, of Frankfort. For several years I have deeply thought of the dangers that might accrue from a careless adaptation of plates, and more especially the fixtures for regulating teeth as inserted in the mouth, and I have made it a practice for years past of tying the fixtures to a tooth, which can generally be done very easily; and the patient can be taught to remove and replace them; if not, it is a very easy thing to adjust them in that way, and to remove and replace them when the patient calls for treatment.

Dr. Darby. The wonder is that people do not swallow these little fixtures that we put in more frequently than they do. I feel that there is danger of their doing so. We have in the museum at the University a plate that was sent to me some years ago which a patient had swallowed, and that had passed through the alimentary canal. That plate is at least one and a half inches long and one inch wide, and it had passed through the bowels. My friend, Dr. Keen, showed me a gold plate, perhaps two or three years ago, with three teeth on it, that a patient had swallowed. She rushed to him and told him that she had swallowed her plate. He at once gave her an active cathartic, and she was thus relieved by a natural process. I do not know but that plate is in use at the present day. There is a case recorded in one of our medical books where a man swallowed a jack-knife upon a wager, and then another, and then another, until he had swallowed twelve, and yet he lived eighteen months.

Dr. Dixon. It is one of the curiosities of medical literature that we have very recently seen a case reported in which a lady lost her life by swallowing a watermelon seed, which lodged in one of the intestines.

The regular meeting was held Saturday evening, November 1, 1884, at the office of Dr. M. Lukens Long, No. 720 N. Sixth street, President Guilford in the chair.

Henry Leffmann, M.D., D.D.S., professor of chemistry and metallurgy in the Pennsylvania College of Dental Surgery, read a paper entitled

SOME OBSERVATIONS ON ANESTHETICS FROM A CHEMICAL AND PHYSIOLOGICAL POINT OF VIEW.

Anesthesia is the most precious gift of science to man. The elixir of life and the fountain of eternal youth will never be discovered, but the diminution of suffering is fortunately attainable. It has been well said that in the days before the introduction of anesthetics "surgery was agony."

Very few of the now living surgeons can realize other than in imagination the scenes of the operating room fifty years ago, or contrast the spectacle of a patient bound to the operating table, conscious of every movement of the knife or forceps, or of ligations, with the present method, under which the patient tranquilly sleeps, even during the most formidable operations known to surgery.

The number of substances that have been proposed, and more or less used, for the production of general anesthesia is quite large, and, doubtless, if there were a great necessity for a variety of agents,—definite promise of superior advantage in further research,—the number could be vastly increased. Until a very recent period the method of producing anesthesia was by inhalation, but we have now the process of administration by the rectum, and, although perhaps objectionable and even dangerous, yet the results obtained show that the effects of the anesthetic are due to its absorption into the blood, and not to mere influence on the respiratory tract. Leaving out of consideration nitrous oxide and carbonic acid (the latter having been proposed but never regularly used), the general anesthetics consist of volatile liquids, derivatives of the hydro-carbons, particularly of those low in the series. Many of the compounds of this series are unsuitable, either on account of their slowness of action, disagreeable properties, difficulty of preparation, or other incidental causes. The experience of the surgeons of this country has been practically limited to three substances,—ethyl oxide, commonly called ether; trichlormethane, commonly called chloroform; and ethyl bromide.

In their physiological action these bodies are all cardiac depressants, chloroform being the most so. The continuation of life requires the maintenance of the functions of the heart, lungs, and central nervous system. Anesthetics attack all three points, depressing the heart power, disturbing the osmodic processes of respiration, and, by poisoning the blood current, affecting the brain. Yet, notwithstanding this, when used cautiously they may be safely employed. Chloroform is undoubtedly the most energetic of the three. Nothing is more regretful in the history of our profession than the deaths from chloroform administered by dentists. Too much stress cannot be laid on the fact that the heart power is so seriously reduced by this anesthetic that it is incapable of supplying the brain properly unless the patient is entirely recumbent. We know, of course, nothing about the intimate action of these agents, and the relative danger is only, therefore, a matter of clinical experience; and upon this topic much difference of opinion prevails. In this city, for instance, are surgeons who rarely use ether, and those who never use chloroform. We may get a suggestion concerning the physiological anesthetics from facts recently derived with regard to intoxicating agents, which are somewhat analogous bodies. It is well known, for instance, that the term alcohol, long restricted to the product of ordinary fermentation, has now acquired a generic meaning, and includes a large number of bodies, some closely resembling common alcohol, and others very different. Without stepping too far into the field of chemistry proper, I may recall to your minds the fact that there are several series of these alcohols, of the first and simplest of which, common alcohol, is the second member. Each of these series consists of analogous bodies, presenting gradually increasing complexity of structure, but never departing from a certain type. The chemist recognizes in each alcohol an arrangement of atoms into a radicle characteristic of the alcohol and all its derivatives. The radicles and the alcohols which contain them may be arranged so as to show a regular increase of carbon atoms in the order of the natural numbers, one, two, etc. Now, the researches of Richardson, Rabateau, and others have shown, I think, conclusively that the physiological action increases in intensity and danger as the number of carbon atoms increase, so that while wood spirit (methyl alcohol), with but a single atom of carbon, is transient and slight in its effects, those of fusel oil (pentyl alcohol), which has five atoms of carbon, are prolonged and severe. It would be a mere speculation, but still I think not an unreasonable one, to suppose that a part of this difference is due to the lower osmodic power and greater difficulty of oxidation in the pentyl alcohol, these being the two methods by which the system gets rid of injurious matters. Much of the phys-

iological action depends on the presence of particular radicles, as Rabateau claims to have shown and proved by the fact that two such bodies as pentyl formate and methyl valerate, which have the same composition, will produce when administered very different action, because one will produce in the blood the comparatively harmless methyl alcohol, and the other the harmful fusel oil.

Now, it does not seem too violent to apply these facts to our common anesthetics. Nitrous oxide is a substance as near to air in composition as any compound could be. It is highly diffusible, soluble in water, and, as experiment will easily show, capable of acting as a supporter of combustion. The functions of respiration and excretion are, therefore, not much taxed by it. It may subserve slightly the purpose of the air which it replaces in the lungs. Ether is a very different substance; its action is more specific, but it is highly combustible,—as much so as alcohol,—and it is therefore quickly and rapidly oxidized, and the result of such oxidation is simply carbonic acid products, to which the blood and lungs are accustomed. As the complexity of the hydro-carbon radicles increases the combustibility decreases, and hence the greater difficulty that the blood has in getting rid of the substance. When, however, we introduce into these organic substances elements which are thoroughly foreign to the processes of nutrition, we get more severe results. Modern organic chemistry has given us extended lists of substances perfectly definite in character, analogous to the true organic bodies, but apparently not only incapable of forming a part of healthy tissues, but also inimical to life. We have, for instance, the substitutive compounds of chlorine, bromine, iodine, nitrogen-dioxide, arsenic, antimony, and mercury. One has only to recall the effect of chloral, iodoform, hydrogen arsenide, and nitro-glycerin, and contrast them with the original organic bodies from which they are derived and to which they are related, to see how the new elements added have increased their toxic action. Here it seems to me we have a clew to the marked action of such anesthetics as chloroform, methane dichloride, ethyl bromide, and carbon tetrachloride. Not only are these bodies difficult to break up (chloroform, for instance, will not yield its chlorine even to silver nitrate), but when broken up the halogen must either be set free or converted into an active form of combination. Observations as to the relative danger of anesthetics, of closely allied character, are not entirely reliable, but one of the most recent essays on the subject, treating of the bodies produced by the successive substitution of chlorine for hydrogen, ascribes the most dangerous and prolonged action to the one containing the most chlorine. The series is as follows:

CH_3Cl. Mono chlormethane.
CH_2Cl_2. Dichlormethane or methane dichloride.
$CHCl_3$. Chloroform.
CCl_4. Carbon tetrachloride.

If the principle here advocated be correct,—namely, that the danger of an anesthetic will be directly as its slowness of oxidation and osmosis, and the presence in it of elements foreign to the typical organic bodies,—we will have indications as to the directions which our researches for new agents should take.

In the actual use of these agents, of course, the physiological action may be controlled by the manner of administration. I have already referred to the danger of using chloroform in the upright position. It is also important to notice that, unless proper care is taken, we may add the dangers of asphyxia to those of anesthesia. A plentiful supply of air is imperatively necessary with chloroform, and the fact that air can be freely admitted without interfering with the effect is one of the reasons that chloroform is in favor. Ether, on the other hand, will not act unless air be pretty well excluded. Many operators fail to get good results from ether, and give it up because, as they say, they cannot get the patient quiet. Most of those who use ether successfully are in the habit of keeping the towel or inhaler close to the patient's mouth, and by this means the preliminary intoxicating stage is passed. Other surgeons prefer to use ether first very lightly mixed with air, until the sensibility of the laryngeal mucous membrane is obtunded. In this way coughing is prevented. I have been under the influence of ether by both methods, and I must say I prefer the latter. The ether was given to me very successfully, and the recovery from the effect was rapid and perfect. By the other method I was so completely prostrated that it was several hours before I could leave the operating room, and I am sure (although I could not have believed it if any one else had told me) that the odor of ether was perceptible to me in my own head for more than twenty-four hours after administration.

In relation to the condition of the kidney, especially in ether anesthesia, it appears that in cases of marked kidney disease, particularly in the now too common Bright's disease, anesthetics are more than usually dangerous. It appears that ether is especially obnoxious, and I have heard an experienced obstetrician say that he had abandoned its use in producing anesthesia in labor, using chloroform entirely. I do not know that it is possible to explain the specific danger from ether in these cases, but it is probably connected with the manner in which the ether is excreted. At any rate, it is now considered proper surgery to test the urine before using any of the stronger anesthetics.

The topics chosen for this paper are too intricate and extended for a single essay. I should like to consider the physiological nature of the analgesic effect of rapid respiration, but I think I have taken up sufficient time, and I would be very glad to hear from those present concerning the questions involved.

Discussion.

Dr. Guilford. I would like to ask you what you consider the physiological action of nitrous oxide, and whether you have made any study of it and of the manner of its action?

Dr. Leffmann. I have never given sufficient attention to it to be able to give what you might call an expert opinion. I think there is some resemblance in it to asphyxia, but I do not think it is asphyxia proper. I would like to know from some of the gentlemen present, who have had experience in the matter, whether the claim made by some parties who have used the gas, that they can prevent the paleness of the face under its operation, is true or not. I remember, from what I have seen in the office of Dr. Thomas, that the faces were quite pale. I have seen some in which the palor was very marked, and I have seen others in which it was not noticeable. It is possible that by an admixture of free oxygen with the gas, say to the extent of five per cent., the asphyxiating effect might be overcome and the anesthetic effect retained. I intended to have alluded to Paul Bert's recent experiment, in which he uses large volumes of air mixed with the anesthetic, giving, as he claims, better results. But whether the admixture of five per cent. of free oxygen would make any improvement, I cannot say. It is an anesthesia of partial suffocation, and I have sometimes thought it possible that the anesthesia of rapid respiration was of the same nature, and that a person breathing so quickly was subject to the same influence,—the true anesthesia of course being the special action.

Dr. Guilford. If nitrous oxide produced asphyxia, would it not be more dangerous than it is?

Dr. Leffmann. I think the primary stimulating effect of nitrous oxide would seem to show a physiological activity outside of the asphyxiating action. There seems to be an impression on the nerve centers of the body, such as you see in ether and chloroform, and in any other anesthetic. There is a resemblance in nitrous oxide to other anesthetics in that respect.

Dr. Tees. About ten years since, Dr. George Watt, of Ohio, made a series of experiments with nitrous oxide upon his own person. He reported the result in the DENTAL COSMOS. He said that he came very near death's door during one of the experiments. He found that, by enlarging the orifice in the inhaler, the patient could breathe

easily, and change of color in the countenance as well as asphyxia could be avoided. No doubt many of you have seen in children blowing trumpets the redness of the countenance. The effect of exhaling through a small mouth-piece, I think, is somewhat the same. About this time Dr. Kimmel had an interview with me, and I called his attention to Dr. Watt's article in the DENTAL COSMOS. Some time after this I accompanied a patient to his office, and noticed while she was under the influence of the gas that there was no change in the color of the countenance, and that she breathed easily, as if in a deep sleep. I spoke of this to Dr. Kimmel, when he told me it was owing to the purity of the gas, and also to the large hole in the mouth-piece, suggested to him by Dr. Watt's communication in the DENTAL COSMOS.

Dr. Gilbert. The less air you have mixed with nitrous oxide the the better success you have in controlling your patient. I think an inhaler with a large hole is preferable, because it is very difficult to breathe through a small aperture. I have tried one of this kind, and I think I had better results from it; but I noticed no difference in the skin, although it may act differently on different persons. About a year ago I was at Dr. Thomas's, and found that he had an inhaler which he had invented with a larger pipe than we can get at the dental depots.

Dr. Guilford. The old plan of administering the gas, breathing in and out of the same bag, was very objectionable. I think the opening in the ordinary inhaler is as large as is necessary. If there is any asphyxia, it is not the fault of the inhaler. In twenty years of experience, in the great majority of cases, I have noticed this peculiar color of the skin, of the eyelids, and of the lips. Did Dr. Thomas explain why he made his large inhaler?

Dr. Darby. The mouth-piece of the inhaler used by Dr. Thomas is very large. He had it made so that the lips could be drawn tightly over it, and held firmly around it, thus preventing the ingress of any atmospheric air.

Dr. Kirk. This is a very interesting subject to me, and one which I have studied from time to time. I think the idea of Dr. Watt incorrect, as it is abundantly proven that the pallor or blueness of the features is due to the replacement of the oxygen in the blood by nitrous oxide. A patient of mine, whom I took to Dr. Kimmel, was very restless while under the influence of the gas. There was no pallor of the countenance, and he said that he felt no pain; but the anesthetic was very slow in taking effect. A slight admixture of air or oxygen greatly lessens this feature of its action, while at the same time its anesthetic property is diminished. A physician of Edinburgh published, some years ago, a series of observations which

he had made upon the absorption spectra of blood, and he found that the venous color was due to the absence of oxygen, and not necessarily to the presence of carbonic acid, as is often assumed; such substances as hydrogen and ammonium sulphide, for instance, being capable of deoxidizing the hæmaglobulin, giving it the dark or venous color, and the absorption spectra of blood deoxidized by these means were identical with that of blood charged with nitrous oxide. I have noticed the same discoloration of the features in a somewhat less degree during the inhalation of pure hydrogen gas, which I have administered for experimental purposes, and carried to the point of anesthesia. It is very rapid in its action, and its effects but transient. When a certain amount of air or oxygen is administered with the gas you can avoid the pallor, but it is a difficult matter to decide just how much air can be given with the gas without interfering seriously with its anesthetic quality. I do not doubt that nitrous oxide acts in the main as an asphyxiating agent; life in the lower animals, such as pigeons, rabbits, etc., can be readily extinguished in a few minutes by keeping them in an atmosphere of nitrous oxide. Its inhalation is unattended with any feeling of suffocation, because the lungs are distended with a non-irritating, respirable gas, but one which is at the same time incapable of supporting life. In the same manner, it is said, one can starve to death without experiencing the pangs of hunger by eating clay. With regard to its permanently injurious effect upon the health, I know of a gentleman who was subjected to a somewhat prolonged operation under nitrous oxide, and subsequently died of diabetes. He always attributed his ill health and the kidney disorder to the inhalation of the gas, though it may have been only a coincidence.

Dr. Tees. All the patients I have accompanied to Dr. Kimmell have been thoroughly under the influence of the gas, and have slept quietly with unchanged countenances during the operations.

Dr. Kirk. I cannot see what harm there is simply in the pallor of the features. While I had charge of the mouths of the children at the Deaf and Dumb Institution I administered the gas very frequently, and often pushed the anesthesia to a profound degree. I have noticed that the first inhalation of pure air almost instantly restored the normal color of the countenance. Immediately upon the removal of the tooth from its socket the first few drops of blood that followed would be of the dark venous color, but in a moment the color would be changed to a bright arterial hue. It is simply a physiological fact that nitrous oxide does produce pallor of the countenance. It is therefore self-evident that the more nitrous oxide you administer the more pallor you produce; and more gas can be administered through a large inhaler than a small one. I do not

think that a small-sized inhaler has anything to do with the pallor of the countenance.

Dr. Darby. I have been in the habit of administering the gas for many years. Sometimes I have noticed the pallor, and sometimes I have not. I have never felt alarmed when it has been most marked. I think it is the large quantity of gas and the absence of atmosphere that produces it. If the gas be mixed with common air, a much longer time is needed to anesthetize the person, and there is a greater liability of having the patient in an excited state, and often difficult to manage. The best results are obtained when the gas is given pure and rapidly inhaled.

Dr. Noble. I think that pallor is due to an absence of oxygen in the blood, because if blood be placed in a receiver, and the air is exhausted and oxygen introduced, the corpuscles will absorb oxygen, change their form, and become red in color. A want of color in the face indicates the condition of the patient. You can analyze the anesthetic effects by the appearance of the face, particularly of the lips.

Dr. Leffmann. The pallor of the countenance is one of the symptoms of asphyxia, and the point we would like to get at in reference to this question is, is asphyxia a necessary condition of anesthesia, or does nitrous oxide gas have an independent effect, and is the asphyxia only an accompaniment of it? If this be so, then we should so modify the gas as to get the anesthesia without the asphyxia. This is plainly so with chloroform; and Paul Bert claims that he has avoided danger from anesthesia by introducing air. If we can administer anything with this gas which will at all prevent the suffocation, and which will not diminish the insensibility to pain, we of course have an advantage. I had an idea, from some conversation with Dr. Kimmell, that his method consisted in mixing air with the gas.

Dr. Kirk. Prof. Elihu Thomson, of the Philadelphia High School, made a series of experiments some eight or ten years ago on the action of anesthetics, and I think performed the same experiment that Dr. Leffmann has just indicated. He found that a mixture of nitrous oxide and pure oxygen, in which the nitrous oxide was relatively the same as the nitrogen was to the oxygen of the atmosphere, was entirely without anesthetic effect, and apparently did not differ physiologically from ordinary air.

Dr. Chupein. I would like to hear whether Dr. Bonwill has made any further experiments in rapid breathing. Dr. Leffmann's paper touched upon that subject.

Dr. Bonwill. I was rather surprised to hear Dr. Leffmann speak of it at all, since I never claimed anything for it under the

head of anesthetics. It does not belong there. I should be very happy to hear anything that he has to say on that subject.

Dr. Leffmann. I would like to say simply a word or two in justification of my position. I am pretty well assured that Dr. Bonwill did not correctly catch the phrase which I used. I used the expression analgesic effect of rapid respiration. I think that is the term which those who agree with him have preferred,—that it is not a condition of unconsciousness, or a suspension of the faculties, as anesthesia is, but a diminution of the sensibility to painful impressions. I have no clearly defined views on the subject, and I am not sure that any extended physiological explanation has been made. I only said that where an unusually rapid change of air occurs in the lungs, without allowing the air time enough to remain in the lungs, it might produce a condition approaching asphyxia. I do not say that that *is* the effect, but I suggest whether the rapid breathing does not produce an approach to asphyxia, if the air does not remain a sufficient time in the lungs to perform its function. Possibly the physiological function requires that the air should enter the lungs and remain there for a moment or so. Now, if we increase the respiration without increasing the amount of the pulse, it may produce such a condition as I have indicated. I am merely throwing this out as a theory which suggests itself to me. I would like Dr. Bonwill to give his views on the subject. I introduced it at the end of my paper, first, because it is not a true anesthetic, and, in the second place, not having any chemical character, being physiological purely, it was rather out of the bounds of observation. Desiring to adhere more strictly to the chemical features of the subject, I simply suggested it in hopes that it would stimulate discussion. In my own case rapid breathing makes me extremely giddy, but I am made giddy very easily; using a blowpipe will produce that effect upon me. My own experiments with the method have been prevented by this unpleasant circumstance. I have no doubt that rapid respiration would interefere with some of the natural functions, and therefore diminish sensibility. We have diminished sensibility from sleep, which is a suspension of some of the natural functions, and I cannot see why we should not have it from the disturbance of other functions. At the same time, I do not see how it can be considered as true anesthesia.

Dr. Bonwill. For eight years my gasometer, holding one hundred gallons, has been idle. I gave nitrous oxide with great pleasure before I thought of rapid breathing, but since then I have used no anesthetic. Dr. Brown-Séquard informed me in 1881 that he read my article on rapid breathing, and knew there were certain physiological facts bearing on the subject, and that he illustrated it in his lectures

before the students. [Dr. Bonwill related a number of cases in which he had successfully operated while the patients were under the influence of this process.] In this act the breathing is five times as fast as usual. When running one must keep up rapid respiration to maintain the proper supply of oxygen in the blood. While the ordinary pulsation is not over eighty, and in rapid breathing is not over ninety, the respiration increases from twenty to one hundred. Now, while the lungs are making one hundred respirations, and the heart maintaining its ordinary pulsations, five times the amount of oxygen is put into the blood, which, mingling with the carbon of the blood, sets free carbonic acid gas. I believe, from all that I have seen, that it is this excess of oxygen in the blood which causes the temporary insensibility to pain.

Dr. Chupein. How long must a patient breathe before this effect is produced?

Dr. Bonwill. It would be almost impossible for one taking one hundred respirations per minute to breathe over a minute or a minute and a quarter; the next minute he would hardly take two respirations, showing that there was an over-oxidation of the blood. The first clinic that I ever gave before any public body was before the class of the University of Pennsylvania. It was a complete success. To that I had the attestation of the students, dental and medical. As far as extracting teeth is concerned, the secret of success lies in the fact that, as carbonic acid gas escapes so quickly, one must operate while the patient is breathing rapidly and before he is exhausted. If five, eight, or ten seconds are lost in getting something ready, or in hunting for an instrument, the result will not be as satisfactory.

Dr. Guilford. I would like to inquire how oxidation of the blood can take place when the oxygen is breathed in and out so rapidly.

Dr. Bonwill. I gave you an illustration of that a moment ago, in the case of a man running.

Dr. Guilford. I understood Dr. Leffmann to say that, when air was breathed rapidly into and out of the lungs, it did not have time to perform its work.

Dr. Bonwill. But take the illustration I gave of a man running. There the action of the heart is quicker, in order to support the increased physical exertion. If there is not the same proportion of air going into the lungs while the heart is propelling the blood so rapidly and forcibly, what will be the result? It will produce asphyxia at once; but, as long as the man takes that amount of air into the lungs which is needed by the increased action of the heart, the increased respiration makes it all right.

Dr. Guilford. But what is it that takes place in your method of rapid respiration? Is it asphyxia?

Dr. Bonwill. No; it is the opposite of asphyxia. Asphyxia comes from a want of oxygen in the blood; this comes from an over-supply of oxygen. The secret is in the heart not pulsating in proportion with the respiration, so as to allow the heart's action to correspond with the action of the lungs.

Dr. Leffmann. I think Dr. Bonwill means that the rapid lung action introduces an overcharge of oxygen into the blood. I do not agree with him in that. I think the insensibility is due to the influence exerted upon the nerve terminals by the depression produced by the defective oxygenation of the blood.

Dr. Bonwill. But is it possible that carbonic acid gas can be set free in the blood unless there is a proper amount of air given to it?

Dr. Leffmann. I think it is possible to accumulate carbonic acid in the blood for a short time, even though no oxygen is allowed to pass in through the lungs.

Dr. Bonwill. In a person deprived of oxygen, what is the color of his skin?

Dr. Leffmann. I should think it would be the same as when nitrous oxide was inhaled.

Dr. Bonwill. It would not be red or flushed, would it?

Dr. Leffmann. No.

Dr. Bonwill. Well, that is the reverse of what you see in my operation, when carbonic acid gas is set free in the lungs, by the large amount of oxygen put into the system. You do not see the same condition of the surface of the skin as you do in asphyxia. It is a fact testified to by many that it takes a minimum quantity of ether or chloroform to affect the patient after he has breathed rapidly first. Why should that be?

Dr. Guilford. To me one of the most remarkable facts about nitrous oxide gas is that it is taken into the system as nitrous oxide gas, and is eliminated from the system without change in its character. The fact that nitrous oxide gas produces a state of insensibility does not prove that the effect is due to asphyxia. The presence of air might interfere with the functions of other agents, but when these other agents exercise their function, the asphyxia may only be incidental. Our object is to get rid of the asphyxiating effect, and obtain a physiological function. If that has been obtained, as it is now claimed to have been, I think it is by a judicious mixture of air and gas.

Dr. Tees. Dr. Leffmann has touched upon the physiological effect upon the lungs of an increased supply of air, and also upon the effect produced in laboratory work by blowing through a small pipe. I would like to ask him whether the same effect would not be produced by breathing through a small orifice, and limiting the supply of nitrous oxide gas in the lungs?

Dr. Leffmann. Yes, sir; I think it would.

Dr. Tees. At a meeting of the Odontographic Society, in 1863, when nitrous oxide was first introduced in Philadelphia, and when our college professors even were ignorant of its effects, it was made and administered for the extraction of a root; there was this bluish pallor and snoring; and fearing the operator, an eminent dentist, was allowing the gentleman to breathe too long, I advised him to remove the bag, and expostulated with him for not doing so at once, telling him that the bag was then full of carbonic acid gas. He denied this, and wished to know where it came from. I said, "From the lungs," and appealed to Prof. Morton, professor of chemistry in the Philadelphia Dental College, for the truth of my statement. The professor agreed with me, saying, "The bag is full of it." Who was right?

Dr. Leffmann. Prof. Morton was right. The nitrous oxide gas may not form carbonic acid; but there is still carbonic acid formed in the lungs by natural process.

Dr. Tees. I think that this discussion points to the fact that the bluish pallor of the countenance shows a deleterious effect, and that the natural appearance, as seen in gentle sleep, indicates the proper condition for the patient to be in. Therefore, I suggest that the members of the society who administer nitrous oxide make it a matter of investigation, and at a future meeting give us the benefit of their experience.

The regular meeting was held Saturday evening, December 6th, 1884, at the office of Dr. E. T. Darby, 1513 Walnut St., Phila., President Guilford in the chair.

A paper was read upon

WHEN DOES INFLAMMATION INDICATE EXTRACTION?

BY JOHN B. WOOD, D. D. S.

The observant dentist cannot fail to note that dentistry, as practiced in the condemnation and extraction of teeth, is far from an exact science. While some practitioners extract too frequently, others take professional pride in preserving all teeth possible, even though the conviction comes, at times, that there is too much of a tendency to sustain this conservative course, upon the questionable ground of hope substituted for faith, when, oftener, justifiable conditions for extraction should be sought.

With some exceptions hereafter noted, no reference will be made to the inflammation of the dental pulp from exposure. Precept and experience teach us that, in the treatment of such cases, a conservative practice should be adhered to; that, usually, no condition exists for the consideration of extraction, the most approved methods generally proving successful in preserving them. I shall therefore confine the subject to teeth that have passed from full vitality to that life still accorded by endosmosis, and to those of such low vitality or complete necrosis, when inflammation, notwithstanding our efforts for its reduction, becomes abiding and rampant; and we look about us in vain for other means for its reduction.

Under the head of supplementary conditions for the consideration of extraction, I would suggest the following:

Where constitutional conditions are unfavorable.

Where peculiarities of blood suggest specific inflammation.

Where the general system is low in tone, with acute nervous susceptibility.

Where, in child-bearing and child-nursing, the system is overtaxed and recuperation feeble.

Where the habits of the patient contra-indicate it.

Where adjoining teeth are in danger of being involved.

Where there will be a serious break in the continuity of the arch.

Where there are no occluding teeth to be injured.

Where mastication will not be seriously interfered with.

Where no embarrassment will result in articulating words.

Where the loss will not be conspicuous.

Where the loss can be replaced by adding to an artificial denture already in the mouth, or where such denture is desirable from other losses.

Where the loss will relieve an overcrowded arch, or where regulation will close the breach, and especially where, in a youthful mouth, the offending tooth is a first molar, and there is fair opportunity for moving forward of the second molar; in this latter connection, the consideration of extraction very often holds good where there is simple inflammation of the pulp.

Where there is inflammation of the nerves of deciduous teeth, and extraction will not be so premature as to cause future irregularity.

Where necrosed deciduous teeth, from non-absorption of their roots, may interfere with second dentition.

I have not presented all the considerations that might arise under the above head, and some of those mentioned may not have much weight; the first six, however, which might be placed under the head of predisposing causes, are so important that anything less than a paper devoted to the subject could not do them justice. I would not be understood as placing in the above category those cases which we diagnose, with considerable certainty, as proper objects for preservation, but such only of apparent doubtful character.

When we consider the unspeakable agony and complete depression of the whole system, that is so often induced by dental inflammation, the query will arise, Would the profession, as a rule, submit to as much suffering for the cause of conservative dentistry as they require of their patients? In the early days of dentistry and in the administration of anæsthetics, when the conclusion was reached that a tooth was not worth the labor and pain necessary to save it, the operator was often uncertain whether the patient, with the marked degree of local inflammation and generally depressed condition of the system, could bear the necessary violence to the parts, or the shock to the system, necessary in extraction, without anæsthesia. In fact, we may be embarrassed at this day, by similar circumstances; also, by the patient's fears of anæthesia, or by the necessary agent not being accessible, and especially on account of organic difficulty of the heart. Where this latter condition contra-indicates extraction, either with or without anæsthesia, we are compelled to resort to slower means for reduction of the inflammation than by removal of the cause; and my experience leads to the conviction that, for promptness of relief and improvement of the surrounding parts, next

to the forcep, comes the leech, applied as often as the capillaries and lymph space become engorged with vitiated blood, as indicated by tension and pain, removing that which otherwise would have to be done by the slower processes of absorption. But, should extraction become necessary in such cases, it would seem much safer to deal with a high state of nervous excitement, produced by consciousness of the operation, rather than an increased physical depression from anæsthesia.

In ordinary cases, without anæsthesia, extraction would hardly be considered dangerous, for, though we may have extreme and protracted inflammation, resulting in very decided physical depression, the operation is so brief—the relief from bleeding of the parts under tension, so great—that reaction takes place almost immediately; so that the condition technically known as shock—which may be simply defined as mental depression, in connection with physical depression, from severe injury, and which, carried far enough, has a paralyzing effect upon the heart's action—could hardly present itself in any considerable degree.

When a tooth is condemned, I believe it is generally best to extract at once, however severe the local conditions, rather than wait for a reduction of inflammation, as, where the cause remains, all methods of relief are but palliative, and nature's efforts at repair, slow. Having removed the cause, the beneficial effect is plainly manifested in the improved spirits of the patient, nature usually responding with alacrity, to restore the tone of the system and the normal condition of the parts. Should, however, the case be one where pus has gravitated and formed a sac in the tissues, or where splintering of the alveolar walls occurred in extraction, or where necrosed bone be present, the condition may be far from satisfactory. Rough and careless manipulation in extraction may also lead to some after-trouble by sloughing of the gums, but, usually, careful lancing, especially by slitting the gums, to provide against laceration when the forceps are pressed home, will prevent this. I would say, further, that, in extraction, especially with inflammation present, the agony of the patient is very much enhanced by the plunging and hauling process, too frequently adopted by those who rely upon main strength to accomplish their purpose, and that the opportunity for the display of skilful manipulation is not so generally embraced as it might be. If, however, anæsthesia can be resorted to, as, happily, it so generally can, then we have not to consider extraction under excruciating circumstances, but to turn to the consideration of the best means for the purpose. Fortunately, science has advanced in the preparation and use of anæsthetics, as in other directions, and we have to-day, in nitrous-oxide gas, an agent that meets the requirement of short operations with great advantage, that, though profound in effect, it is quite evanescent, so that the patient, though physically depressed from acute suffering, or the

wasting of disease, may reasonably be expected to pass under its influence and out again, without meeting death or serious bodily disturbance. Nevertheless, it is questionable whether the prolonged use of it is as safe as that of some other agent, from the fact that even a brief exhibition of it generally produces ashy pallor—the result of depression—and complete relaxation of the capillaries.

In conclusion, I must freely admit that we are not always certain when inflammation indicates extraction. Although we may classify for and against extraction, the constitutional weaknesses or idiosyncrasies of our patients too often compel a wide variation in practice from theories laid down.

Discussion.

Dr. Kirk. In forming a judgment as to the propriety of saving or attempting to save a tooth which is undergoing suppurative inflammation, I am largely controlled by the rapidity with which the process is going on. It has been my experience that those cases of alveolar abscess which reach their climax in a comparatively short time—and pus is discharged freely, in considerable quantity—are the most amenable to treatment, and are less liable to subsequent attacks; while those which are affected, from the first, with a low grade of inflammation, extending over a long period, and in which the inflammatory products are of the fibrous or plastic type—forming a gristly mass over the region of the apex of the root—I have always found difficult to treat; and, as a general rule, are better out of the mouth, as their retention gives constant trouble and annoyance.

In regard to the action of anæsthetics upon the heart, I have had, lately, two patients, both with heart trouble, to whom nitrous oxide was administered successfully, without any ill results whatever. One was a young lady with marked valvular disease, from whom two offending molars were removed; and the other was a lady with abnormal enlargement of the heart, for whom a minor surgical operation, requiring several minutes, was performed. In both cases, there was no marked disturbance of the normal pulsation; the only effect noticeable was a slight quickening of the beat. The anæsthetic was given to both, with full knowledge of the heart lesion, and because it was considered safer, by the family physician, to do so, than to operate without any anæsthetic, as, by the use of the gas, all shock was avoided. It is my belief that where patients are so far debilitated by heart disease—or any disease, in fact—that they cannot withstand the effects of the gas, it would be decidedly dangerous and wrong to subject them to the much greater shock of operating without it.

Dr. Jefferis. I am sorry to see a tide rising in favor of extraction. I think it is better to try to save the teeth than to take them out. When

there is fibrous growth about the roots, it has been my experience that there is nothing to do but to take out the teeth. This disease is more apt to occur in the wisdom teeth than in any other, especially when they are devitalized. I think the only cases of abscesses that have come to my notice, in teeth with pulps alive, have been with inferior wisdom teeth, and they had to be extracted. I have used gas in hundreds of cases, during the last fifteen years, and I have never had any trouble on account of its interfering with the heart's action at any time. I have given it to persons who were troubled with consumption for a long while. In one case of this kind, the lady had to rest, going to and from her home, because she could not walk far, yet she took the gas without any trouble. I have a great deal of confidence in its use as an anæsthetic, and it certainly enables us to do many things which we could not do without its aid. I have never used chloroform.

Dr. Tees. An extended experience in the conservative treatment of pulps, inclines me to believe that the greatest trouble comes from those that have died a natural death, as the result of such treatment. In cases where the pulps have been devitalized by means of an arsenical preparation and then extirpated, we find a comparatively small percentage of abscesses. I am very persistent in the endeavor to save teeth, and do not cause my patients, in so doing, a great deal of pain, relieving them, in a majority of instances, by opening into the canal and giving vent, at intervals, until a cure is effected. However, when the inflammation is persistent, and can only be subdued for a few weeks at a time, we are justified in extracting. In extraction, our judgment is often influenced by the absence of an antagonist. The wisdom teeth, especially, which we often find extending above the level of the other molars, should be removed, when there is any inflammation caused by devitalized pulps.

Dr. Chupein. I think we all try to save too many teeth. I missed one of my patients—a lad—for a long time, and when he again came to me, I found that one of his teeth had been extracted by another dentist, the whole denture being very much improved. I was satisfied that I would not have extracted it, and therefore judged that the dentist did better than I would have done.

President Guilford. The subject of the essay is so closely allied to that of anæsthesia that we will be glad to hear anything that relates to either subject. The subject of anæsthesia was before us at our last meeting, and I was sorry that Dr. Thomas was not present to hear the very able paper that was read by Prof. Leffman, and the interesting discussion that followed it, particularly to that part referring to the cause of the livid color of the lips and eyelids of the patient under the influence of the gas.

Dr. Thomas. As you all know, the subject of nitrous-oxide gas is one

that is closely allied to my own practice and experience in connection with the extraction of teeth, and I naturally take a great interest in it. I was very much gratified to hear Dr. Wood's paper, and to note the very conservative position he takes upon the subject of extracting teeth. I can heartily say I agree with him in all he has said. There is no doubt in my mind that, in the effort to save many teeth, the patient is frequently subjected to much suffering and inconvenience, for very little practical advantage, and I have no hesitation in saying that the endeavor to retain some teeth is carried to too great an extent by the profession at large. I was sorry not to have heard the paper read by Dr. Leffman, at the last meeting, to which you have referred; but, in relation to administering the gas so as to produce absolute insensibility to pain, and, at the same time, prevent, entirely, any discolor of the countenance, I very much question if it can be accomplished. It has been my experience that the gas does not produce a depressing effect upon the action of the heart. Some years ago, I took a register of the action of the heart, under its influence, of one hundred cases, and in only two out of the whole number did the pulsation fall below the normal beat, and these two were of exceedingly feeble circulation at best.

I attribute the discoloration to the accumulation of carbonic acid in the blood. It shows more in some cases than in others. With persons of plethoric habit, there will always be more or less discoloration, which can be mitigated, to a great extent, by the admission of a little air during inhalation. For instance, I administered the gas to-day, for the amputation of a toe. The operation lasted three minutes, and in that case, there was no discoloration, as the anæsthetic effects were kept up by alternating the gas with occasionally a breath of air. The intense pallor can be prevented in this way. In large, full habits, however, it cannot be entirely avoided.

Dr. Guilford. I would like to ask Dr. Thomas whether he has had any beneficial results from the use of a large inhaler. I understand he has one.

Dr. Thomas. Yes, sir. I have one that is larger than those in general use. The object of a large inhaler is to permit the patient to breathe perfectly free, without effort, and produce no evidence of suffocation. Discoloration will be a great deal more marked if there is any difficulty in breathing.

Dr. Chupein. Dr. Thomas spoke, a short time ago, of his inhaler admitting a certain quantity of air, for the purpose of preventing this discolored appearance. I was always under the impression that the admixture of air with nitrous-oxide gas prevented the action of the gas. A gentleman who took the gas recently said to me: "I knew everything that was going on, although I could do nothing. I felt no pain, but I

knew what was being done, although I was incapable of moving." So I thought it might be the admixture of the air with the gas, which neutralized the action of the nitrous oxide.

Dr. Thomas. That is usually the case. It is a fact that, if there is a constant admission of air with the gas, it will not produce absolute insensibility. I have heard people express the same thing, and say they knew what was going on, but still were unable to resist. That, to my mind, seems due to some imperfection of the inhaler, or to some defect of the gas, or to the mode of administering.

Dr. Kirk. On the question of whether a patient is conscious or has any knowledge of the operation under nitrous oxide, I would like to cite my personal experience. The first time I inhaled the gas for removal of a tooth, was under the care of the late Dr. F. R. Thomas. When I had sufficiently recovered to talk, I said to him, "Doctor, I felt you remove that tooth," but he told me he was sure I did not. As I was still under the effect of the gas, and in rather a belligerent frame of mind, I was quite irritated at him for doubting my assertion. I was always firmly convinced that I was right until I had occasion to submit to the same operation again—this time by Dr. J. D. Thomas—when I saw, very clearly to my own mind, where I had been mistaken. The tooth was removed, and I recovered consciousness under the mistaken impression that, through some accident to the apparatus, I had failed to get enough gas, and would have to go through a second administration. As sensation returned, however, I suddenly felt a dull, throbbing pain in the alveolus from which the tooth had been removed, and I am convinced that it was this first conscious sensation that I had before attributed to the shock of extraction. Since then, I have frequently verified this point in patients for whom I have operated under the influence of the gas, and in every instance, I am convinced that they have mistaken the residual pain in the parts, following the operation, for the removal of the tooth.

Dr. Darby. I have known persons to mistake the removal of the pipe for the removal of the tooth.

Dr. Thomas. It has been my experience that the condition of the mind has a great deal to do with one's sensations and ideas, when under the influence of the gas. Two cases occur to me, which, I think, go to show that fact. Some years ago, an elderly gentleman, sixty years of age—who had a tooth which, on two occasions, he had tried, unsuccessfully, to have extracted without an anæsthetic—presented himself for the operation under the nitrous oxide. During the inhalation, he began shouting and struggling to such an extent that it was impossible to do anything but endeavor to hold him. After recovering himself, he cried out, "Doctor, do you call that pulling teeth without pain? I never suf-

fered so much in my life." He had actually suffered, in his mind, all the torture of his previous experiences, and was dumfounded when we assured him that his tooth had not been touched. After his excitement had passed away, we gave him the second inhalation, when he was as quiet as if in his bed at night, and the tooth was removed without any difficulty.

The other case was one of a gentleman who had three teeth extracted. After the operation, and while I was at the wash-stand, he raised his finger three times, and immediately asserted that he knew when each tooth was extracted; and had not his friend been standing in front of him and seen it all, it would have been impossible to convince him that the teeth were all out when he raised his finger first, at which time I was not near him.

Dr. Tees. Does the admission of a large amount of gas through the large orifice of your inhaler cause a greater degree of pallor?

Dr. Thomas. Not at all.

Dr. Tees. Would a large supply of gas be more likely to cause asphyxia than a small amount?

Dr. Thomas. I think not. I have found it to be my experience that the larger the amount of nitrous-oxide gas you administer, the sooner you have a beneficial result.

Dr. Guilford. I believe Prof. Leffman gave it as his opinion that the effect was produced by the nitrous oxide gas occupying the air-cells in the lungs, to the exclusion of the air, and by so doing, prevented oxygenation of the blood.

Dr. Thomas. I do not think you could produce a narcotized condition of the patient in that time. I have seen performers in theatres hold the breath, under water, for a minute and a quarter, and yet retain consciousness. The gas, as an anæsthetic, acts directly upon the nerve centres.

Dr. Darby. I would like to ask Dr. Thomas if he knows anything about the compound oxygen they are giving in Girard street. I understood Prof. Leffman to say that it was nothing but water charged with nitrous-oxide gas.

Dr. Thomas. I know, of course, nothing about how it is made, but I am told that it is made of nitrate of ammonia; and I do not know that they can produce from nitrate of ammonia anything but nitrous-oxide gas.

Dr. Guilford. At the last meeting, Prof. Leffman stated that he had found a bottle of this liquid, and in testing it, discovered a strong trace of lead, which he thought came from the tank in which it was kept. I at first supposed the water was given the patient to drink, but I have since learned that the directions are to heat it, and inhale the vapor as it comes off.

Dr. Wood. While the subject is before you, and particularly while Dr. Thomas is here, I wish to state an instance in my practice that illustrates a case of justifiable extraction. But, first, I would remark that no one knows so well as the dentist who has had the patient in hand, and who is familiar with his peculiarities, when extraction is justifiable. To illustrate: I had a gentlemen in my office some months ago, who had been a patient of mine for years. I knew him particularly well. He said: "I have been to Dr. Thomas to have a tooth extracted, and he declined to do it for me. He asked me who my dentist was, and said he could not extract so good a tooth without the endorsement of my dentist." I told him Dr. Thomas would undoubtedly have good reasons for declining. I examined the tooth—left superior wisdom, as I remember it—and, apparently, there was nothing the matter with it; certainly no decay, and as certainly no inflammation that was noticeable. The patient stated that, for three weeks, he had been much annoyed with the tooth, of late losing one-half of his usual sleep on account of it. As I could not condemn the tooth on sight, I treated it for about two days. The patient became more impatient and depressed, declaring he would not be subjected to such annoyance for any tooth in his mouth; in fact, his actions were suggestive of lunacy. Calcification in pulp canal suggested itself; but, knowing my patient of old as one liable to be upset upon the slightest provocation, I did not credit his case with anything extraordinary. I concluded the tooth might cause suffering from its crowded position, and, though there was good occlusion with the inferior wisdom tooth, it was not needed for mastication. I reluctantly gave him my card to Dr. Thomas, and extraction resulted in immediate and permanent relief.

INCIDENTS OF PRACTICE.

Dr. Wood. I would like to ask whether there are any well-authenticated cases of third dentition, or tertiary dentition.

Dr. Guilford. I do not think there are any.

Dr. Wood. A lady acquaintance of mine, living in Virginia, and about fifty years of age, reports to me that, a few months ago, she had all her remaining teeth extracted, and, since that time, there have appeared upon her lower jaw three protuberances, one of which has developed a good tooth of fair size, and the others are advancing. In the upper jaw, she says, there is enough swelling to indicate a full set, but only three places promise an early eruption.

Dr. Guilford. Did you see her mouth?

Dr. Wood. No; but I hope to, soon, and to verify the case, should it prove to be of importance.

Dr. Guilford. The reason I asked the question was that, a few years ago, I became interested in the case of a man who had never had any teeth, and it directed my attention to the subject of anomalous dentition more fully than it had been before. In the course of my reading, however, I did not come across any well-authenticated case of third dentition. Where cases of this kind were referred to, there was either lack of evidence to confirm them, or, upon examination, they turned out to be wisdom teeth erupting late, or members of the second set that had, from some cause or other, been prevented from erupting at the proper time; in other words, they were individual evidences of delayed dentition. Many years ago, while in the office of a country physician, a patient of his told me that his son had a double row of teeth all around, as he expressed it. I went with him to his house, to see the anomaly, and found that, in the boy's upper jaw, the cuspids had erupted close to the centrals, while the laterals were standing separately, inside of the arch. This was the only peculiarity in the mouth, and had been magnified into a "double row." People are easily deceived; and in making an examination of this character, the knowledge of an expert is needed, in order that there may be no chance for a mistake.

Dr. Thomas. I have frequently seen crowns of other teeth protruding after adjacent teeth had been extracted. I remember, very well, one case in which, after taking out the canine and second bicuspid, the crowns of the first bicuspid, on either side, were visible. I called the attention of the patient to it, and told her what it was. If I had not done so, she would have probably thought there was a third set of teeth. I have never seen a case in which there was a third tooth, except anomalous cases of delayed dentition.

Dr. Chupein. I deal at a druggist's near by, and he asked me if I had any report to make in reference to the hydro-chlorate of cocaine. I told him no, as the material was very difficult to procure. He said he would try to procure some for me, but, in the meantime, he thought that a solution of caffeine would produce the same anæsthetic effect, and he would send me a little bottle of it. He gave me some of it, and I divided it and sent some to several dentists in the neighborhood. My daughter was sick, at the time, with the measles, and, having a root of a lower bicuspid that was giving her pain, she sent word to me to send something to her to relieve it. I sent some of this hydro-chlorate of caffeine to her, and it gave instant relief. The pain passed away, and she did not have a return of it. A lady came in, a day or two afterwards, and I gave her a small portion, and asked her to report the result. She came back in a week, and said that it had not been effectual at all. So much for the caffeine. Now, about the hydro-chlorate of cocaine. I procured some, lately, and made several applications with it, but it was

not effective. I had one case of a lower molar, with a large defect in the crown surface. I placed the rubber dam in position, and, with a drop-tube, I took up a drop or two of the hydro-chlorate of cocaine, and dropped it into the cavity. I let it stay about a minute and a half—which might have been too short a time—but it was just as painful as before the application. I tried it again, but it produced no better effect. Yesterday, I had a case of two bicuspids, upper first and second. The pulp in the first bicuspid was dead, but there was exquisite pain in the canal. I put some of the cocaine in that, and worked it up with a small probe, to reach the nerve. I let it stay there for at least fifteen minutes, while I prepared the cavity in the second bicuspid. At the expiration of that time, it was just as painful as before. I made a second application, but there was just as much pain as at first.

There is another remedy which is spoken of in the dental journals—a preparation of caustic potash and carbolic acid, in equal parts. I believe it is generally known as the Robinson remedy. I applied it to a tooth in which all the decayed dentine was removed, and it gave considerable pain at the time of the application, but, in a minute, the pain passed off. I prepared that cavity with no more pain to the patient than if it had been a tooth in the hand. On another occasion, I applied the same thing to some of the soft dentine that we meet in largely-decayed teeth, and that was so painful that the patient could not bear it.

Dr. Kirk. In the treatment of pericemental inflammation, I have had the most gratifying results from the stimulant and counter-irritant effects of capsicum. When applied during the initial stages of pericementitis, its stimulant action often promptly relieves the congestion, and further progress of the trouble is stopped; or, if the inflammation has already progressed so far that abscess is unavoidable, the continued application of capsicum undoubtedly shortens the course of the attack by hastening the formation of pus. The admirable little capsicum bags suggested by Dr. Foulks, I have used extensively, but I have found them open to two objections. Their form being more or less convex, they do not adapt themselves nicely to the surfaces to which they are applied; these also being convex or bulging, as a consequence they shift around, and it is difficult and often impossible to get their action at the exact point desired. The other objection is their comparatively high price. I have devised a little arrangement which I think is an improvement, as it certainly overcomes the objections I have named, and is, at the same time, fully as effective. I will pass some of them around for inspection, while I describe the process of making them: A sheet of ordinary, heavy white blotting-paper is coated on one side with a film of gutta-percha, by dipping it into a solution of that substance in chloroform; after this has thoroughly dried, the other side is saturated with a ten-per-cent. solution

of the oleo-resin of capsicum, and allowed to dry. From this sheet, little disks are cut with a circular die, for which a gun-wad punch, No. 8 gauge, answers admirably. These are bisected through their diameters with a sharp knife or chisel. This gives a semi-circular pad, which, when applied with the capsicum side over the apex of a tooth, adapts itself nicely to the tissues, while the film of gutta-percha protects the cheek and tongue from irritation. The pad just described can be used as a vehicle for applying almost any medicament locally, for the treatment of pericementitis. I have used aconite, also ginger, in the same way, and there is no tendency to slip around or become misplaced.

1885.

The regular meeting was held Saturday evening, January 3d, 1885, at the office of Dr. Thomas, No. 912 Walnut St., Philadelphia, President Guilford in the chair.

A paper was read upon

THE PRACTICE OF EXTRACTING WITH NITROUS OXIDE GAS AS A SPECIALTY.

BY JOHN D. THOMAS, D. D. S.

In complying with the request to read a paper upon the subject of Nitrous Oxide, it was at first found puzzling to decide how it could be presented to make the matter most interesting It seemed hardly worth while to treat it from a chemical standpoint, or as an anæsthetic, for upon these there has apparently been said all that thoughtful study of experienced minds has been able to unfold, and anything I could say would be but a repetition of that which is perfectly familiar to you all; upon its physiological effects I know of nothing of recent development that would throw any light and give decisive conclusions, which would tend to unite the different opinions held by various authorities.

My individual conviction is, that the gas acts directly upon the nerve centres, first as a stimulant, then as a narcotic, and that the discolored appearance of the patient while under its influence is due wholly to the accumulation of carbonic acid in the blood, independent of any change of the gas taking place in the lungs.

I have, however, become associated with its use more in a practical way than as a student of its effects. This has been found to demand experience on the part of the operator, the use of absolutely fresh and pure gas and the closest attention to detail in administering it. The transient effects require a steadiness of nerve and an aptness of operating which will tax the ability of the average man to its fullest capacity, since to give entire satisfaction the patient must not have the least knowledge of any part of the operation. This calls for discernment in the different stages of the anæsthetic, so that the operation will not be commenced too soon or continued too long. Then with the gas perfectly pure and fresh, there will be no unpleasant after-effects to follow. Upon these principles success has commanded such recognition of its merits, that, to-day, it is acknowledged by the Dental and Medical professions, to be the safest and most desirable of all the anæsthetics for dental purposes and minor surgery.

Experience, however, has clearly demonstrated the fact that the duties

attending the successful use of the gas, are too exacting to meet the entire satisfaction of the general practitioner of dentistry. The great diversity in the dispositions of different patients and the variety of temperaments one meets with, the effects of the gas acting upon hardly two alike, calls for an experience in handling them that can only be acquired by devoting so much time to it as to seriously interfere with other official duties. In consequence of this, its use has been generally abandoned in private practice, particularly in large cities, which has rendered the services of the specialist in extracting with nitrous oxide a necessary adjunct to the profession at large, and has inaugurated a very acceptable system, with very few opponents, of recommending patients requiring extraction, to him. This has been found advantageous to the dentist, who is relieved of the anxiety which invariably accompanies, to a greater or less degree, the giving of anæsthetics by one of limited practice, as well as a great saving of time; while it is as much to the satisfaction of his patients, for it insures to them the operation being performed in the most skilful manner, and the certainty of having the gas of the best quality; so with your permission, I will invite your attention to the subject of the evening: "The practice of extracting teeth with nitrous oxide gas as a specialty." It is now twenty years since the gas was introduced—or I may say, re-introduced, for it was but the revival of that which had been discovered a score of years before—and twenty years since the office was first opened in this city for the purpose of extracting teeth as a specialty; and though the gas, as an anæsthetic, is acknowledged on all sides to be of incalculable benefit to suffering humanity, the practice of using it for the purpose of extracting teeth as a specialty, is considered by some to be a detriment to the cause of dental science, rather than a blessing. It may be that the methods utilized by some of those who were instrumental in introducing its use for dental purposes, were not in strict conformity with professional ethics. Whole-page advertisements and platform exhibitions are not conducive to gaining confidence and respect; in consequence of which the progress to professional recognition has been necessarily very slow; and though it has ever been my aim, since the practice has been my care, to so conduct it that it could take its position as a special branch of the dental profession with as much honor as any of the specialties of medicine bear relation to that profession, it is evident that, at large, the position of the specialist is still an equivocal one. It is regarded by its opponents as an illegitimate practice, bearing no relation to dentistry, since it is the province of that profession to build up and restore the dental organs to their original usefulness, while it is the apparent object of the nitrous oxide specialist to break down and destroy those organs; consequently his business can be but one of malpractice, and can claim no standing as a part of the dental profession. It is possible that the

practice offers opportunities to one so disposed, to extract teeth that can be saved if the patient is so convinced; and there are some who inconsiderately think that this is the daily practice of the specialist. I have even heard it said that you could not expect a man whose interests lay in the extraction of a tooth, to go contrary to that interest and advise its retention; as though being a specialist he could be possessed of no higher motive than greed of gain; but, upon the same principle, would we not expect every physician to retard the recovery of his patients as long as lay in his power, in order to extend his visiting fees? also, for every dentist to promote the growth of caries? to fill teeth with inferior materials, and in fact, do everything conducive to the perpetual employment of his services? If such were the fact, then the charge of malpractice might well be sustained; but this is not the case with the conscientious specialist. I contend that the practice of the specialist can be made a perfectly legitimate one and as much a part of the dental profession as the many specialties of medicine are part of the medical profession, provided the practitioner be a graduate of dentistry.

If you will pardon the personal allusion, I can say for myself, that in all my practice I have yet to knowingly advise the extraction of the first tooth which, in my judgment, could have been saved, the patient being willing to submit to treatment. There may be differences of opinion as to what teeth should be extracted and what be saved; but in forming one's judgment several things have to be taken into consideration: such as the character of the teeth and the temperament of the patient; and it must be borne in mind that those coming to the specialist, do so under great stress of pain, and constitute, for the most part, a wholly different class of people from those visiting the regular dentist.

I will ask your attention to the following figures: In the city of Philadelphia we have a population, in round numbers, of one million inhabitants. In this one million of population, according to the medical directory, we have nearly three hundred dentists, including only those who are regular graduates, and constitute the dental profession proper. Upon inquiry it is found that each dentist operates in a year for about two hundred persons, some more and some less, of course, but as near as can be averaged it is concluded about that number. This does not mean the separate engagements, for we recognize that any one of them might fill anywhere from one to twenty or more different appointments. This shows that out of a population of one million, only sixty thousand persons, or six per cent. of the whole number, are under dental care in a year. Of the sixty thousand who have given attention to their teeth, I have extracted in the past year, by their dentists' direction, for eighteen hundred, or three per cent. These eighteen hundred cannot by any means include all nor perhaps one-fourth of the number in the sixty

thousand who have had to undergo extraction; for many dentists do their own extracting, particularly if no anæsthetic is required, and others have recommended elsewhere; but grant at the outside, that these may show that notwithstanding all the attention and skill bestowed upon them, fully six per cent. of all the patients under dental care, have occasion to submit to tooth extraction, it is possible that this estimate has been made too low. Since writing the above, figures have been presented showing that some operate for upwards of four hundred, and one has put the number as high as six hundred for whom he operates in a year. It would be difficult to get the exact number of people who visit the dentist in a year, without collecting from each dentist individually; but perhaps four hundred would more than cover the average for each one, this would double the foregoing estimate of patients under dental care, making it one hundred and twenty thousand, or twelve per cent. of the whole population; and allowing the extractions to remain the same it would reduce the rate to three per cent., which would make a very good showing for the success of dental treatment.

What proportion of the balance of our population requires the service of the dentist, I have no means of finding out. Some are cognizant of the benefits derived from dental science, but are relieved of the necessity of making visits each year to their dentist; but the great mass of them constitute that class before alluded to, which might be termed the uneducated class; uneducated, however, only from a dental point of view, in that they have never acquired the knowledge of what can be done for them in saving their teeth by placing them under the care of a competent dentist. Unfortunately this seems to include the majority in all communities; but this is not surprising when we consider that many years back and for centuries before, the most popular way of relieving toothache was by extraction. The manner and method of performing that operation were productive of the most excruciating tortures, so that the impression upon the minds of old and young alike was one of lasting character. Notwithstanding the great progress made by dental science and the facilities for acquiring knowledge upon the subject offered the public, the greater portion of our population still labor under the impression that the only remedy for an aching tooth is extraction—these are the patients with whom the specialist comes in contact as a class, and they are capable of several subdivisions. A large number of our population suffer with the toothache, who are unable or disinclined to pay anything for dental services, and avail themselves of the advantages offered by the Dental Colleges and Dispensaries for relief by extraction.

They have no thought of treating and saving their teeth and probably have not the means to pay for the service if they did; their only object is to get relief from their pain, and it is a Godsend to them that this can be

obtained by the asking. But the first of the class whom the specialist meets, consists of those who are able to pay the dentist's fees, but who have never realized the necessity of giving their teeth attention, from the fact of being endowed by nature with an excellent set; the whole of both rows with perhaps one or two exceptions, being perfectly sound, they have neglected attention to the defective ones until they are surprised by a lively toothache. It being a new experience to them, and impatient with suffering, their first and only thought is, to obtain the quickest means of relief; they come with their minds fully made up to have the teeth extracted, and any suggestion that would lead to induce them to have the teeth treated with a view to saving them, will invariably be met with the query, "Will that stop the pain right away?" and the thought that preliminary treatment may cause some suffering and require a little patience, will preclude any effort being made in that direction, and they will order them out at once. It may be a case in which the operator will feel perfectly confident that with care and attention the tooth can be saved, and if the patient has been educated to the importance of saving his teeth he will do doubt be thankful for the advice; but such seldom comes to the specialist. If, however, he does not realize the importance of the tooth and wants no further trouble with it, coming in great pain and wanting relief, he is certainly a very important person in the consultation as to how that relief shall be given; and if he in his deliberation decides upon extraction who can question his right to do so, or censure the operator for complying. I ask the question, Is extraction in such a case malpractice? The second and perhaps the most numerous class, are those whose teeth are about on a par in quality with the majority of those who constitute the sixty thousand or one hundred and twenty thousand who are annually visiting the dentist, but whose education has been sadly neglected in this particular. They have ample means and can afford the expense that dental operations incur, but because of their ignorance of the benefits to be derived from submiting to the hands of a dentist, they have allowed their teeth to decay until they are past redemption; having extracted one, two or three at a time, as they give them trouble—and if perchance, as is often the case, they decay without causing a great deal if any pain—they will let them go until they present themselves with a view to having all extracted and artificial ones inserted. These cases usually come in great pain, probably with faces badly swollen, all with minds settled upon extraction, and nine-tenths of the teeth in such condition that any dentist would unhesitatingly recommend immediate extraction; and although there might be a possibility of saving the other one-tenth with care and good treatment, it is very seldom one can be found willing to submit to the experiment. I ask again Is it malpractice to afford this relief to such sufferers? It is among this class that

the specialist, through his influence, can be the instrument of accomplishing a world of good; and the conscientious man, after extracting those which are beyond the possibility of reasonable success in treating, will embrace every opportunity of advising the retention of those remaining by having them cared for and filled. In the matter of extracting the roots and defective teeth for those who have in view the insertion of artificial ones, there certainly can be no alternative in the case. There are people with whom very little headway could be made in treating the roots and adapting artificial crowns; it would be folly to mention such a thing. In extracting, the specialist has a consciousness of accomplishing much good, not alone in the relief given, but to the health of the patient as well; for there is no doubt that many diseases derive their origin from imperfect mastication, the result of defective teeth; and many are the people who would have been the victims to-day of dyspepsia and its kindred ailments, had it not been for the painless extraction by nitrous oxide. There are other cases presenting themselves to the specialist, in sufficient numbers to be rated in classes; among them those of exceedingly nervous temperament, with extremely sensitive teeth, who from dread of undergoing the operation of filling will hesitate until they are made aware of the dangers of delay by the appearance of an exposed pulp, and then prefer to lose the tooth to having it treated.

There are those also who have given every attention to the preservation of teeth, involving the expenditure of large sums of money, which has resulted only in temporary benefit; and to save them with any degree of permanency would have been next to impossible, and would have necessitated constant and frequent visits to the dentist; so they have lost heart, and becoming fully persuaded that further expenditure of time and money is useless, have determined as they decay and give pain to have them extracted and artificial ones inserted. These compose the principal cases which come under the care of the specialist. He will of course discriminate in advising extraction in all he does. There are many patients who present themselves that will accept advice and have the effort made to save their teeth; and I have been the recipient of commendatory letters from members of the profession for my discretion in refusing to perform extraction in certain cases; but the most appreciated have been the letters of thanks from patients who received from me their first suggestion of the possibility of saving and restoring their organs of mastication.

In all my experience there have been but two conditions in the treatment of teeth, under which the practices of the regular dentist and the specialist have clashed, and to these I invite your especial attention. The first is where the dentist has made application to a freshly-exposed pulp for a

patient of that temperament which will not permit him to submit to much pain, with an easy grace; and perhaps, as is mostly the case, he may not be in hearty accord with the efforts of saving the tooth, but, on the whole, would about as lief lose it as to try and save it. If the pain does not cease in a short time, he makes up his mind to have the tooth out, and with that object in view will hasten to the specialist. In such a case a refusal will be given to extract, and everything said and done to urge patience on the part of the sufferer; but when the patient will not accept advice to submit to further treatment, but insists upon extraction, what is to be done? Under such circumstances is it justifiable to subject him to prolonged suffering against his will, when he certainly has the prior right to demand what shall be done with his own tooth? Would not the dentist, even against his own judgment, perform extraction in such a case?

The second are cases of prolonged treatment of abscesses. These have been weeks or perhaps months in visiting their dentists for applications and dressings, and though the dentists may have every hope of ultimate success, the patients can realize very little, if any, improvement, and give it up in disgust, and come to have them extracted. In these cases it is not a sudden impulse inspired by acute pain, but a decision after mature deliberation; though they desire to save the teeth if it can be accomplished with less annoyance, they do not consider the retention of the teeth of sufficient value to compensate them for the trouble and expense which the effort seems likely to incur. So they determine to have them extracted. In all these cases, it is my practice to urge upon patients perseverance in the treatment, and in no case to sanction extraction contrary to their dentists' advice. After that, to my mind, the responsibility of the operation rests upon the patients, and can in no way reflect upon the professional integrity of the specialist.

It has been my earnest endeavor as well as that of others so to conduct the specialty of extraction that it will in no way conflict with the regular practice of dentistry, and to elevate it from its position in earlier years; with what success I leave others to judge. It is with feelings of deep satisfaction that I have the consciousness of working with the dental profession to the one end—the greatest good to the greatest number.

Discussion.

President Guilford. I suppose the members have been sending their patients so generally to Dr. Thomas that they do not have any new experience in the matter of administering the gas; but they can at least tell what they think of the agent and its effects upon their patients. If Dr. Barker were living I know he would have something to say.

Dr. Darby. I have been very much interested in Dr. Thomas' paper.

He has not treated the subject in just the way I had supposed he would, and yet possibly in a more interesting way than I should have done. I think we all feel that Dr. Thomas is a great convenience to us as a profession, and he certainly seems to be appreciated by the community in general. As dentists, he relieves us of many disagreeable operations. In the earlier years of my practice I liked to extract teeth and was not averse to the use of anæsthetics, but as I grow older I find I am less fond of extracting teeth and more and more disinclined to anæsthetize persons for whom extraction becomes necessary. Such, I doubt not, would be the testimony of most men who have had years of experience as dental practitioners. It is certainly a great relief to be able to send our patients for extraction, to a gentleman in whom we have the greatest confidence, who is not only skilful but conscientious as well. Oftentimes when people are suffering from pain in a tooth, they will apply at once to the specialist to have it extracted, and not infrequently they would, under the pressure of existing pain, sacrifice a valuable tooth. I have several times known such instances, and at the earnest solicitation of Dr. Thomas, the person has been induced to apply to a regular practitioner and have the tooth saved.

A conscientious man sees something beyond the fee which he would receive for performing the operation, and it gives me pleasure to testify in this public way to Dr. Thomas' sense of right; without this he would not have the confidence which so many of us bestow upon him and his specialty.

Dr. Kirk. There is one question which Dr. Thomas raises which is certainly important, and that is when a patient comes to him with his mind fully made up to have an aching tooth extracted, and though advised against it, is still determined to take the law in his own hands, is it, or is it not, malpractice to allow such a patient to have his own way? It seems to me there is nothing left to be done in a case of that kind but to extract. The patient is usually in a state of desperation from the pain, and if the specialist declines to operate he will undoubtedly seek relief at the hands of some other operator. Many people cannot, nor will not endure the pain even to save the tooth ultimately; and in such cases I cannot see how the charge of malpractice can be made against the operator who removes the offending tooth. In my own experience I certainly have never had occasion to charge Dr. Thomas in his treatment of any of my patients, with doing anything that was not justifiable under the circumstances.

Dr. Jefferis. I think that these questions in regard to malpractice are very pertinent, and ought to be boldly met. No doubt Dr. Thomas has been very unfairly criticised by a great many who are extracting such teeth themselves. In many of the cases which he describes, where most

of the patients have previously made up their minds to have the teeth out whether or not, if he were to take upon himself the task of advising them to save the teeth, he oftentimes would be drawn into an argument with no profit to himself and no benefit to his patient.

Dr. Register. I think the paper of Dr. Thomas is purely a dental subject. I was somewhat disappointed in the purport of it, a defence of himself—I do not think Dr. Thomas needs any defence, so far as his personal efforts go towards doing good in his specialty, being conscientious therein. With the majority of people dentistry begins and ends in extraction; with them it is the alpha and omega of the profession. The question which presents, "whether a tooth under treatment should be extracted by a specialist," should be thoroughly met by the profession. I do not think it is good practice to allow the patient to decide for himself under any circumstances. There is very often a case where the operator has been giving a great deal of time in trying to save a tooth, putting forth his best efforts, and perhaps is just about to reach a favorable result, when under the immediate impulse of a little pain the patient rushes to a specialist to have it extracted. Under such circumstances the specialist ought to positively decline, unless a note requesting him to do so is sent by the operator. If he complied with the request, which, alas! he too often does, without such instruction, he not only deprives the dentist of his fee, but what is still more, subjects him to the chagrin and disappointment of failure.

Dr. D. Neall. When I first began to practice dentistry, a great many years ago, about the only thing known of a dentist was that he drew teeth. And if a child happened to meet him on the street he would cross over, run away and cry "there is the man who pulled my tooth out." Then it was done in a crude way, and it was torture. Then came nitrous oxide. Providence pointed it out. I say it reverently, and the torture became pleasure. Now, take care! That involves a great moral question. You do not give a man pain but remove it from him; and when he comes to you suffering from an aching tooth and prays for the relief which you can give him, even though you think the tooth can be saved eventually, can you say no? There comes the point. Will you act as the old Roman did, according to his conscience as well as his judgment, and say "No?" And when the poor sufferer comes day after day until his patience is exhausted and then goes to a specialist and insists upon having that tooth out, will you condemn the specialist if he extracts it? For one, I would not refuse to extract a tooth because a professional brother is forced down for a moment, nor force a patient to bring a certificate before relieving him of pain. I often wish we had to bear a little of the suffering ourselves, then we would know better what we ought to do. I wish the nitrous oxide man had been in my office to-day and that he could have

helped me out of a dilemma I was in. We have all seen the articulating surface of a wisdom tooth growing up, little by little, against the posterior surface of an inferior second molar. I had such a case to-day, and I tried to get it out, but I could not do it. I did not wish to extract the second molar. I took the Physic, brought all my strength to bear upon the tooth, but I could not move it If any brother has any advice to offer I would like to have it.

Dr. Darby. I can tell Dr. Neall what a gentleman wrote me he did with a Physic. He had a fractured jaw to treat afterward.

Dr. Daniel Neall. Well, I did not fracture the young woman's jaw. I did try to move that thing backward and forward, but I am not sure that I ought not to be punished for it.

Dr. Guilford. I can tell Dr. Neall what happened in a case of that kind a great many years ago. I forget whether Dr. Thomas or his brother, Frank, was conducting this special office. An old friend, a naval officer, came to me with a lower wisdom tooth in a bad position, which he wished to have removed. It presented its masticating face to the distal surface of the second molar. I administered the gas and took hold of the tooth, but I could not move it; I re-administered it and tried again, but I failed a second time. I then sent him with a note to Dr. Thomas. Some days after, he called and told me that Dr. Thomas said that if I could not remove the tooth he could not; the fact of the matter was, it was a bad case and nobody wanted to undertake it. I suppose that tooth is in his head to-day.

Dr. Register. I have had one or two cases of this kind that Dr. Thomas has taken out very successfully for me. I will be very much obliged if he will state his method of operating in such cases. I think they are the most difficult cases we have to contend with.

Dr. Thomas. They are really the most difficult teeth presented to us for extraction. I used to pride myself a great deal on my ability in taking them out, but I have come to the conclusion that in nine cases out of ten the second molar is the proper one to take out. Of course you lose to some extent the full use of the wisdom tooth, but in taking out the wisdom tooth, in many instances the anterior cusp will press to such an extent that it will destroy the septum or process between it and the second molar tooth, so that in a year the second molar will become loosened, and probably lost, as shown here. On the inside the bone is very thin. By taking a good hold of the tooth and turning it until you get the under cusp, which is the anterior side, under the second molar, next the tongue, they can be easily taken away. I had one case which came to me in January, where the man, four months before, had had such a tooth extracted, and in the attempt to extract it the inner plate of bone had been broken and had caused a succession of abscesses under the tongue and

in the cheek. When he came to me to learn the cause of the trouble, I found that the fracture extended from the second molar tooth down to the inferior dental canal, so that I came to the conclusion that rather than run the risk of undergoing any results of that kind I would take out the second molar and let the wisdom tooth come up to its place. The dentist was not to blame for the accident, for that might have happened to any one—the fault lay in not removing the broken bone, too. It may have been a disappointment to some that I did not present the subject of my paper in the way it was expected it would be presented. I prepared it as an answer to a great many things that have been said in reference to the use of nitrous oxide gas. In other associations, and particularly in the American Dental Association, the question of extracting teeth as a specialty has been discussed to a great extent, and has been frowned upon, saying that it was a wholesale slaughter or sacrifice of teeth; that it was not part of the dental profession; that he who practiced it was an outcast entirely, who should not be recognized as a professional brother, and that it had no connection whatever with the dental profession. As I said in my paper, I have endeavored to make the practice a strictly legitimate one, and I believe I have succeeded in doing so. There are so many patients who insist upon having their teeth extracted that we must ask ourselves what is malpractice in such cases. Of course if a tooth can be saved it would be malpractice to extract it, but the patients who come to me are not those who will consider whether a tooth can be saved or not. If they wanted their teeth saved they would go to a regular dentist, and therefore I ask the question, Is the extraction of their teeth malpractice? I am sorry to-night that two or three gentlemen who are opposed to the practice, and to whom I extended an invitation to be present here, did not respond. I told them that we would let them express themselves as fully as they desired; but they are not here to participate in the discussion. To me it is a disappointment, because the gentlemen are able members of the profession, and I would have liked them to take part in this interchange of opinion.

In regard to the other point, the extraction of teeth which are under treatment, to which Dr. Register refers, I hold to the ruling that, under such circumstances, the specialist has a right to take such a tooth out during the term of treatment. The practice I have always followed is under no circumstances to advise the extraction of such a tooth. But a patient comes in suffering and says, "I won't try to save this tooth any longer, and I want it out." Now, what is to be done in such a case if the specialist is not permitted to extract? If I advise a patient to try and save a tooth, and he refuses to take my advice, and elects to have it out, is it wrong for me to take out that tooth? I desire the question

answered. I would like an expression of opinion from the members; shall I in all such cases refuse to relieve the patient?

Dr. Faught. I am very much interested in the matter presented, particularly in the last point as to whether the specialist has the right under any circumstances to extract a tooth while under treatment. My own view of the matter is that under no circumstances whatever without the written consent of the operator should he extract such a tooth. It is certainly very mortifying and places the practitioner in a very peculiar position, after he has been carrying out a line of treatment, with ultimate success in view, to receive word some morning that the appointment is canceled because the patient has had the tooth extracted. I speak with some feeling on this point, because of my own experience in relation to it. A lady called at Dr. Thomas' office and wanted one of her teeth extracted. Dr. Thomas very considerately referred her to me and I began to treat the tooth; everything was going along very satisfactorily, it was almost to completion, and, in fact, I had made the appointment for finishing the work, when the success of my efforts was prevented and all my labor lost in just that way. I do not know where she went to have the tooth extracted. I certainly think there ought to be some stop put to that kind of practice, and I would not look upon him as a reputable and conscientious practitioner who should thus step in and mar my work. If the patient is dissatisfied with the treatment or gets into a nervous condition, and says, "I cannot stand this pain any longer and must get relief," and wants the tooth out, let him apply to the dentist under whose care the tooth then is, for permission to do so, or at least inform him of his intention, but not betray such utter disrespect for the previous personal advice by rushing off to the specialist and demanding its extraction.

Dr. Darby. I differ very materially from the views expressed by Dr. Faught. His theory is very good as a theory, but does not work as a practice. A patient may be perfectly satisfied with his dentist and with all that he has done for him, but he is not satisfied to suffer pain any longer to save his tooth or please his dentist. He may have every confidence in him and believe that he will be able ultimately to relieve him of his suffering, but he feels that the sacrifice is too great, he has stood the pain as long as he thinks he can, and as long as he will; the tooth is his, he has a right to do with it as he wills, and out it must come. Now, that is no reason why the patient should sever his relationship with his dentist. He has simply exercised the prerogative which all of us would demand—the right to do as we please with our own. I cannot blame my fellow man for doing just what I should feel at liberty to do under similar circumstances. I feel confident that my patients will suffer as much pain for me as for another dentist, I am also confident that they suffer more

that I would be willing to do were I in their place, but there is a limit to the amount that we can reasonably expect of them, and because their limit is not our limit we must not censure them for going contrary to our wishes. The tendency is to blame the specialist who relieves our patient of the offending tooth, but a second sober thought ought to assure us that he is not blameworthy.

Dr. Bonwill. Dr. Thomas, do you extract teeth in all stages of inflammation?

Dr. Thomas. Yes, sir, I do; certainly.

Dr. Bonwill. Have you found any subsequent trouble from extreme suppuration, or necrosis?

Dr. Thomas. No, I cannot say I have. I cannot say that I ever had a case wherein there was necrosis, or suppuration, augmented by taking out a suppurated tooth.

Dr. Bonwill. Do you have any cases coming back to you after extraction?

Dr. Thomas. Yes. There are cases coming back for treatment for inflammation, or diseased bone; but if it is a case in which I regard the tooth as the cause of the inflammation, I would recommend the extraction of the tooth, as a blood-letting process, and treat the disease afterward. It will get well when the cause is removed and there is nothing to excite further.

Dr. Bonwill. Are there not cases coming to you from the hands of dentists, where, in your judgment, it would be better for the tooth to remain than to be extracted?

Dr. Thomas. If a patient comes to me from a dentist, I have no opinion whatever. Sometimes patients come in to ask advice, after having previously received the advice of their dentist, and say, "Dr. Thomas, do you agree with that?" If I can agree with it, I will endorse it by all means. If it is a question in which the opinion might be one way or another, I tell them candidly. But, if there is any dispute, I tell them, "I am not your dentist, and I have no opinion pro or con." If a patient comes to me with a card from a dentist, asking me to take out a tooth, whether it is a front tooth, or a sound tooth, I ask no question but take it out according to direction.

Dr. Daniel Neall. Suppose there might be some mistake in the card, what then?"

Dr. Thomas. Whenever it is a palpable error, I will correct it. For instance, if the dentist intends for me to take out a tooth on the right side, and says the left, I will know it is a mistake. Such errors are always easily corrected; but teeth ordered out for the purpose of regulating, I have no opinion and never express one.

Dr. Bonwill. I would like to ask Dr. Thomas if he has ever seen any

cases of pyæmia, and whether he believes that if the tooth had been extracted previously, it would have prevented it, or whether, if the tooth had been extracted after pyæmia had taken place, it would have resulted in the death of the patient?

Dr. Thomas. I have never met with any case of the kind.

Dr. Bonwill. What would you do under such circumstances?

Dr. Thomas. I would extract under any circumstance if the patient was in ill health, the system run down, and the tooth the cause of the depression; I would remove the cause, and then commence to build the patient up. Through my advice a lady in delicate health had a bicuspid treated. I told her under no circumstances to lose it. She had not lost any of her upper teeth and but one lower; she went to her dentist for treatment and abscess followed destruction of the pulp. Seeing her at diff rent times while she was under treatment, I advised her to apply ginger and a pepper-bag to bring about the abscess as quickly as possible. She finally lost the tooth. The bone surrounding it and between the first bicuspid and the first molar became necrosed. This extended from one tooth to another until she lost every tooth back from the eye tooth, and the antrum was perforated. Now I contend that a tooth under such circumstances ought to be taken out instantly. If that tooth had been removed in the first place I am satisfied she would have retained all the rest.

Dr. Bonwill. Can you tell whether that was caused by inflammation, or by carelessness in the application of the arsenic?

Dr. Thomas. I have seen hundreds of cases where the extraction of one tooth has been delayed to such an extent that it has been the means of losing the adjoining teeth, if not more. The patient will often call in a physician to consult about an abscessed tooth under treatment who will take the case into his own hands and tell the specialist to take it out without delay. A case of this kind caused a great deal of discussion before the Pennsylvania Association of Dental Surgeons on one occasion. A patient of one of the leading members wore a plate over two roots, from which there had been a constant discharge giving her a great deal of trouble, but he would not consent to have them out, because it would interfere with the setting of the plate, until her physician said he would allow it no longer, and he brought her here and had the roots extracted.

Dr. Guilford. There is another point the paper did not touch on, and that is the after-effects upon the patient. The society would be glad to hear from Dr. Thomas or any other member in reference to it. It is a question that has been largely discussed in the journals at different times, more so formerly than at present. Cases have been reported of ill effects following the administration of the gas, but in the course of my twenty years' practice, (part of it in a rural village), during which time I have

given gas several thousand times, I have never known of any evil effects. Many present will remember that both Dr. Barker and Dr. Webb, while living, declared that they felt such ill effects in their own persons.

Dr. Darby. I am very glad Dr. Guilford has mentioned that, because several persons have said to me that they had never been well since taking the gas.

Dr. Thomas. From my experience in the administering of the gas, I do not believe there is any ill effect whatever. I have never known any which could be traced to the gas. I have had probably half a dozen cases where people have made complaint that they were not well after taking it or that some serious effect had taken place which was ascribed to the gas, but I do not believe that such was the case. In the office we do not have a patient sick at the stomach once in six months—and then it will be such a person as will sicken at the sight of blood—or one with whom any nervous excitement will disturb the stomach or cause him to faint. There is another class of people whose stomachs become disordered from long suffering with a loss of appetite and general prostration. I have known such cases where sickness has followed, subsequent to the extraction of the teeth, and was attributed to the effects of the gas, when it really was the result of the previous prostration and nervous excitement, or a severe bilious attack, which culminated after the operation.

I had a patient, a lady, who came on a Tuesday during the heated term of the Centennial year. I gave her gas and took her tooth out. The day preceding, her menses had started. On Thursday night her mother came and said her daughter was in a terrible state; she was out of her mind, and she was sure the gas was the cause of it. At first I thought it was a case where the gas had had some ill effect, and I felt very much exercised about it. I went for a physician in whom I had a great deal of confidence. Upon questioning her and her mother he found that during the previous afternoon she had taken a cold shower-bath, which had checked the menstrual flow and caused cerebral derangement.

In another instance a lady came to see me about her little girl. Two weeks before, she had taken the gas and now complained that her child was feverish and sick, and had been so from within two or three days after she had taken the gas. I did not understand it, but I did not question her statement. After inquiring minutely after the symptoms, I told her to consult a physician about it. She did so and found that the child was just being taken down with scarlet fever. Of course there are many people who take the gas when on the eve of some constitutional change, that it is impossible to tell what may happen at any time, but I have never known a case in which the ill effects ascribed to the gas has not

been capable of satisfactory explanation to some other cause. Take the case which has been mentioned in the little book published by my brother, in which a patient sent for us. We were asked in the afternoon to go to the house and administer the gas, and we could not do so until the next morning. We got there only to find that the patient had died during the night. Suppose we had gone the afternoon previous and given the gas to the patient when they really wanted us to do so, it would have been the gas that killed the patient, in the family's estimation. To me it is really remarkable that there are not more cases of that kind happening, because people die in the street. They are dying all the time. They go through a great deal of nervous excitement attending the suffering beforehand, and coming to the operation is itself calculated to produce great excitement, and it is a wonder to me that persons having heart and other affections do not have more trouble than they do. I have investigated a great many cases where the gas was complained of as being the cause of trouble, and in every case it was found that it was something else.

Dr. Guilford. Do you not think, in the cases reported years ago, these effects were mostly due to the fact that the gas was either not pure or improperly administered?

Dr. Thomas. We do not hear of it nowadays. Then we had the gas kept as long as we pleased, and sometimes it would produce asphyxia. As far as the cases of death which have occurred, I do not believe that one that has been reported could be ascribed to the gas—that is, to the gas itself, made right and properly administered.

Dr. Bonwill. Do you find much trouble, when a crown breaks off, in extracting small portions of the root, or are you successful in getting them out in all cases?

Dr. Thomas. I do not always have trouble. This occurs sometimes in cases of exostosis. If it is an inflamed root and can be easily extracted, it is better to do so, but I do not approve of cutting through the process to take it out. This is a difficult operation, and sometimes will cause suffering for a long time. I would leave it for a couple of days, and then if it gives trouble I would poultice it so as to make an abcess. If it is left there for two or three months it will work up so that it can be removed without any trouble.

Dr. Register. I would like to place myself upon record as not being too arbitrary in regard to teeth that are under treatment. To appreciate the toothache you have only to put yourself into the patient's place. Shakespeare knew what it was when he called it emphatically the "hell of all diseases." I do not think any one in this room, when treating a patient, would be so unreasonable as to allow him to suffer unnecessarily long. It is more in regard to those patients who are impatient, to whom

the retention of the teeth is nothing compared to the endurance of a little pain, and who resort to the specialist for the removal of the cause without giving the treatment a fair trial. Although the majority of us in our earlier years may have been filled with a fondness "to yank" out the teeth, yet as we grow older and settle into responsible practices, patronized by people who appreciate their teeth, we change our opinions.

Dr. Wood. I feel that I appreciate the specialist most in those cases where the extraction of the sixth-year molar is imperative for the future welfare of the mouth; it is too much, at that tender age, to ask of the patient without the use of an anæsthetic. I have never seen a case of inflammation too serious for extraction, unless there were other than local considerations, and I have never had any bad results from extraction when acute inflammation was present.

Dr. Tees. A paper of this character, a little out of the general order of scientific matter, I think is a relief to us, especially at this time, after having discussed nitrous oxide, from a chemical standpoint, at the two preceding meetings. I was interested in it as an anæsthetic when introduced by Dr. Colton of New York, and having experimented in its manufacture a great deal in 1863, I ascribe the ill effects at that time to the impurities in its manufacture, and the crude way of administering it. I found that it required a great deal of care to prevent the white fumes of nitric oxide from being formed and passing into the receiver. This probably, together with breathing in and out of the bag, and thus inhaling the carbonic acid from the lungs, had much to do with the unruliness of patients and their frightful dreams. One young lady assured me that she thought she was in hell being punished for her sins. I was soon led to abandon it in my practice, and send the patients to a specialist. The introduction of the valve, the enlargement of the orifice in the mouth-piece, breathing pure gas from a large gasometer and exhaling into the atmosphere, all tend to prevent any ill effects. I look upon the specialist as a great blessing. He is of especial assistance to dentists in active practice when called upon to give relief by extraction while otherwise engaged. Although pertinacious in my treatment of diseased teeth, yet when the patient presents himself, after prolonged treatment, and tells me that the tooth has been extracted, though sometimes humiliated, I feel glad nevertheless. When a patient insists upon having a tooth out, and will not listen to any argument in favor of having it saved, it has been my practice generally to extract it or have the specialist do so, it being better to take it out and give relief at once.

Dr. Guilford. Much as has been written upon the subject of nitrous oxide, there are still many points in reference to it that never before have been brought out so fully as they have been to-night, and all present will

be satisfied, I think, to have these opinions go out to the world as the sentiment of Philadelphia dentists on the subject.

Dr. Wood. Is the physical sense acute when the mental is not? Is not the condition of one reflected upon the other? A patient of mine, from reverses in business, had aberration of mind for several years, but was very quiet, devoting himself to the perusal of a pocket Bible which he always carried with him and from which he would read or quote to any indulgent listener. During this time on two or three occasions I extracted teeth for him, and he always came into my office with this perverted quotation, "My tooth offends me, pluck it out." There never was any expression of dread or pain whatever from him, neither were there any further remarks, and in fact it seemed like extracting teeth for an automaton. Since his recovery I have occasionally extracted for him, but always find him susceptible to pain, and to-day I believe he is procrastinating about some roots he wishes removed.

Dr. Guilford. Before we adjourn I wish to make a few remarks from the chair.

Lately, through an advertisement, my attention was called to a little work recently published, that briefly but clearly explains the law as applied to physicians, druggists and dentists. Though costing but $1, it is so valuable that it should occupy a place in every dentist's library.

In these days of easy prosecution it is very important for each practitioner to thoroughly inform himself as to his liability before the law, not only in regard to accidents occurring, but also his rights in the matter of bills, the methods for their legal collection, the proper manner of keeping book accounts, collections after death, and many kindred matters. All these are treated of in the work, a copy of which I have brought with me for the members to look at.

The title of the work is "Williams on Laws Relating to Physicians, Druggists and Dentists," and is published by E. L. Bowman, 130 South Sixth street, Philadelphia.

The regular meeting was held Saturday evening, February 6th, 1885, at the residence of Dr. Daniel Neall, No. 1627 Summer Street, Philadelphia.

Dr. Chupein was called to the chair.

INCIDENTS OF PRACTICE.

Dr. G. Roberts. I present a model of a case of irregularity which has recently come into my hands. The patient is a young man aged nineteen. In the upper jaw the left lateral has erupted inside and the cuspid outside of the arch; the right lateral has been extracted, and the space has closed perfectly. In the lower jaw there is a generally irregular condition of the six oval teeth. I will advise the extraction of both laterals, then the teeth will straighten themselves. If the case was that of a lady, I would extract the first bicuspid; then both cuspids would have to be forced back, and the upper lateral forced out, which would be very easy to do; but young men in business will not always submit to this treatment.

Dr. Register. Considering the age of the patient, I would take out the left superior cuspid and force the lateral into place, after which I would cut off the inner cusp of the first bicuspid to make it look like a cuspid.

Dr. D. Neall. I would gain room in the lower jaw by taking out one of the incisors and the left first bicuspid, after which the remaining teeth could be readily brought into line. In correcting the upper jaw I would extract the left lateral, and then draw down the cuspid.

Dr. Bonwill. I know nothing of the Herbst method of filling teeth, but from my knowledge of mechanics I have no doubt that by keeping the instrument used absolutely bright, so that it shall cause little or no friction, the gold can be condensed so as to be beaten into plate. This might do well in some cases, but when it comes to filling all the different forms of cavities in all the various positions in which we find them, I do not see how it is possible for it to meet all the conditions. I think it is only another illustration of what we often see. Dr. Herbst has made a hobby of filling teeth in this way, and has studied its possibilities, and he can probably do more with the method than any one else. In regard to the use of the matrix (which is part of the system), any one who is at all conversant with the facts must know that it is in many cases impossible to adjust one. It will do in approximal cavities, where there is plenty of room, or where it can be put in tightly, but when you have to carry it out on the buccal,

or palatal surfaces and get at the angles, its use becomes impossible. As to the mere rubbing together of two pieces of gold so as to make them cohere, any one can do that with an ordinary burnisher; but to get the gold into all the little pits, or to build a contour operation that will stand, you cannot do it in this way. As regards speed, Dr. Bodecker, who went to Europe and studied Herbst's method thoroughly, took with him the Bonwill electrical and mechanical mallets, but Herbst beat him in time. In their tests it was determined that you could not pack more gold in a given cavity by this method than with the electrical or mechanical mallet. Long ago I proved that there can be packed one-sixth more gold in a given cavity with the electric than with the hand or any other mallet. I have not the exact figures by me, but I have packed approximately two books of foil in one hour and twenty minutes with the electrical mallet, and one book in thirty-five minutes with the mechanical mallet. Why do we want greater speed or more solidity in a filling than this? One reason why so much praise has been bestowed on the Herbst method is that European dentists have never before given to the profession anything of value in this direction, and they are disposed, therefore, to make the most of their contribution. Had Dr. Bodecker been as familiar with the electric or mechanical mallet as I am, there would have been no such result as indicated by him.

Dr. Dixon. A lady about sixty years of age fell, some two years since, breaking off the lower third of the right superior lateral incisor and loosening the adjoining central. After her recovery the central was so elongated as to quite disfigure the patient. It was forced into its proper place by the application of a fixture prepared for the purpose. But upon removal of the pressure, which had been maintained for six months, the tooth in a few hours returned to its unsightly condition. The fixture was then returned and retained until the tooth was again forced into place. I then bored a small hole in the approximal surface upon a line a little below the fractured end of the lateral. Into this hole I fastened, with gutta-percha, a small piece of gold wire extending some two-thirds across the fractured end of the lateral, upon which I built firmly a gold filling, restoring its contour. This was done some six months ago, and the central has been held perfectly in its place.

Dr. Register. Was there any pyorrhea?

Dr. Dixon. There was some absorption around the mesial border of the neck, but no considerable pocket.

Dr. Bonwill. I am reminded by this case of some experience I had in placing artificial crowns, which satisfied me that, if you do not allow it to come in contact with an opposing tooth, the root will

elongate, unless the pericementum can be kept normal as before the death of the pulp. But a band or a poorly-fitting crown will act like a rubber band, and gradually force out the root.

Dr. Register. A patient of mine, a boy, inherited from his father a peculiar type of jaw and teeth. The father's upper anterior teeth project so far that the lip does not cover them, and even though he wears a large moustache, the teeth are seen all the time. In occlusion the incisors of the lower jaw strike into the gum behind the superior incisors. The oval teeth are abnormally long, while those from the bicuspids to the last molars are unduly short. The little boy has teeth of the same character, only the deformity is intensified. When he was first taken in charge, his upper incisors projected at an angle of forty-five degrees, so that they hung over like the incisors of a sheep. I had talked with others about the case at the outset, and they discouraged any attempt at interference. The deformity was inherited, they said, and the teeth would be sure to return to their original positions when the force which held them was removed. Nevertheless, I have undertaken to remedy the difficulty, and have been working to that end nearly three years. My idea was that to insure success I would have to break up the continuity of the tissues and make a new process. The first permanent molars were just through the gums when the treatment was begun, and yet they appeared to be fully erupted. I knew I could not get articulation unless I could by some means make the other teeth which were to come grow to a greater length. The upper incisors were first brought into proper position by means of a rubber strap, having a silk loop at each end. This apparatus afforded ample opportunity for cleansing the teeth readily. It was put on loosely at first, and tension was made as required. The treatment of the lower incisors, which in occluding cut into the gum behind the upper teeth, was commenced. I cut off the cutting edges slightly, at short intervals, until they began to feel sensitive, when I would desist for a fortnight or more, after which, the sensitiveness having passed away, I would resume. Finally they were got into position. Of course the lower teeth were somewhat shortened, but they articulated nicely with their antagonists, and altogether presented a good appearance. A crib plate was then constructed, and it was extended back over the molars so as to keep the mouth open a quarter of an inch. As the temporary molars were gradually lost, I found that the bicuspids were growing, or, perhaps better, lengthening proportionately. My opinion is that, unless some such means as has been described had been adopted, they would not have been as long as they now are by one-third. The bicuspids are now about fully erupted, and it is my intention to take off the crib

plate and extract the first permanent molars, and then put on a T retaining plate, which will be worn six or seven years. The boy is now ten years old, and I think there will be good occlusion of the teeth. The enamel seemed perfect, and, though the teeth were so loose at one time while they were being moved that I believe I could have taken them out with my finger, they are now firm and well set. The rubber straps were adjusted by making cavities in the buccal surfaces of the second temporary molars, into which small pins were built, and these were used as bases in pulling the teeth into place.

Dr. Bonwill. Where the teeth are so much displaced, especially if they are of a "type," they will go back to their original positions when the fixtures are removed. When the irregularity is acquired this does not occur. While practicing in Delaware I had a case of irregularity caused by thumb-sucking, where the deformity was so great that you could put two fingers between the incisors of the upper and lower jaws when the mouth was closed. It was readily cured and there was no return to the former state. But in the "type" cast it will return again, or is far more liable to do so.

Dr. Dixon. What is a "type?"

Dr. Bonwill. I know only one definition. Dr. Register says the father's teeth and jaw are of the same character that he finds in the child, only in the latter the abnormality is intensified. That is a "type."

Dr. Dixon. I have seen teeth regulated where the type, I believe, had prevailed for generations. If the operation is performed gradually, the process is not absorbed, but follows the teeth. If commenced when the patient is about thirteen years old, the age which I prefer taking them in hand, and continued for a year or more, it will succeed.

Dr. Bonwill. Dr. Kingsley has done as much in the way of regulating teeth as any one here, and his experience, as recorded in his "Oral Deformities," is that when the malposition is typal the teeth will return in time to their old positions, and he will not touch a case that is typal with the expectation of making a permanent success of its regulation. It is only those cases where the deformity results from mechanical causes, as thumb sucking, injudicious extraction, accidents, etc., that can be successfully treated. Such is my experience.

Dr. D. Neall. Where the irregularity is of mechanical origin it can be corrected by mechanism, with nature back of it. When you have the angular jaw type, the teeth will go back after being regulated. Where you have the rounded arch you can correct permanently.

Dr. Register, I believe that disease might become a type. The

grandfather* of the child whose case I have just described had nothing in the way of a dental deformity, but his son acquired a malformation of the jaw in some way, and now the child of that son shows the same deformity intensified. I believe I can change this, and if I can maintain the new conditions long enough—until nature, so to speak, begins to recognize the new parts—the change will be permanent, and the teeth will not go back.

Dr. Dixon. If constant pressure is placed upon a growing structure like that of the developing human jaw, and firmly maintained in its changed position until new granulations have taken place, it cannot go back.

Dr. Tees. If the anterior teeth have been kept in their abnormal positions by an insufficient length of the bicuspids and molars, and if Dr. Register has elongated them, I should think the treatment ought to be successful. In regulating, the tooth is moved away from one of the plates of the alveolar process. If, with the forceps, we move a tooth violently backward or forward, we may fracture one of the plates; but if it is moved slowly, as in regulating, the process will move with it.

Dr. Register. I think that the full meaning of Dr. Bonwill's definition of what constitutes a "type" was not fully appreciated by all who heard it—that is, the idea that from conception there is a type of the future being formed; that this type is persistent, and that there is constant tendency under all changes to go back to the original idea from which it grew. I believe that, where the changes are forced for years, what we may call a secondary nature, is formed. In pursuance of this idea the patient whose case I have described, should wear the plate all his life, if necessary, taking it off occasionally and reapplying it if the teeth show any tendency to go back.

Dr. Bonwill. Many years ago I encountered certain difficulties in placing teeth in proper articulation by means of the instruments in use at the time. I found that the lower human jaw was very nearly a perfect equilateral triangle, about four inches on each side. I also observed that the curve at the ramus varied with the bite of the natural teeth, and investigated the reason for it. Based on these studies I invented an anatomical articulator. You will find that most dentists articulate teeth only on the outer cusps, but if you will look at nature you will see that the teeth are articulated on the inner cusps as well as the outer ones. The practical application of this articulator shows how nature has pre-determined not only the various shapes of teeth—their sizes, length, width and thickness—but also the varying

*Have since learned that one of the grandparents had just such a dental deformity.

lengths of the cusps on all—the depth of the over-bite, the curvature of the teeth at the ramus, the sizes of the arches and their depth, as well as the expression. It is in this connection that I now speak of it, to illustrate how nature will follow a pre-determined course, whether it be normal or otherwise, which is difficult to change, except through several generations; you can modify but seldom correct the deformity in the living subject.

At the annual meeting held May 2, 1885, the following officers were elected to serve during the ensuing year:

Edwin T. Darby, *President;* Henry C. Register, *Vice-President;* Ambler Tees, *Recording Secretary;* H. K. Leech, *Corresponding Secretary;* E. H. Neall, *Treasurer;* W. G. A. Bonwill, *Librarian;* E. C. Kirk, T. F. Chupein, and J. W. Noble, *Executive Committee.*

THE regular meeting was held Saturday evening, March 7, 1885, at the residence of Dr. H. C. Register, 1907 Chestnut street, Philadelphia, President Guilford in the chair.

The following paper was read upon

THE SETTING OF PORCELAIN AND OTHER CROWNS,

BY S. B. LUCKIE, D.D.S.

The placing of an artificial crown upon a root is the last operation the dental practitioner can perform to retain the service and appearance of the natural tooth. It is therefore incumbent upon him to use every precaution to avoid any accident that might interfere with a possible necessity for a repetition of the operation. To meet the many requirements that present themselves, it is necessary to be eclectic in the selection of a crown, and to endeavor to restore to usefulness and beauty the organ in the simplest manner, yet give to the operation when completed the greatest strength in every part.

The Bonwill crowns are sufficient to meet the requirements in a large majority of cases, and their construction and method of attachment have been frequently explained by Dr. Bonwill. There are some additional points, however, which I think may well be considered. After the root is prepared, to prevent splitting it, a small groove should be cut around the canal, between it and the cementum, which, when the pin is adjusted, the root filled, and the crown pressed to place, will solidly fill with amalgam and support the root on all sides.

If it is a root in the anterior of the mouth, the exhibition of a discolored joint may be prevented by placing a small quantity of light-colored gutta-percha, softened by heat, around the edge of the concavity of the crown, and at once adjusting the crown. A tight joint will thus be made, which will prevent the showing of the amalgam externally. Any excess of gutta-percha which may have been forced out should be trimmed off flush with the root and crown.

If a case presents where decay has progressed to such an extent as to leave only a funnel-shaped cavity, and but little substance for retaining the pin near the apex, a thin platinum band should be placed around the root, with a strip from it, to be turned and burnished into the cavity, to prevent the band from slipping beyond the edge of the gum. Then close the foramen, select a small probe—

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a Gates canal-drill with bur broken off answers well—and insert it in the root and pack amalgam around it; using either the Bonwill or the electric mallet to work the mercury well to the surface, removing the mercury with a piece of bibulous paper, and so manipulating the amalgam as to have it hard by the time the filling is completed. Then withdraw the probe; this leaves a canal that answers well as a guide in drilling. You now have a root almost as good as if it had not been injured by decay, and the operation can be continued after the usual method.

When the root is perforated in one or more places, I use a piece of platinum foil, cut into a shape that may be adapted to the walls of the canal, as a lining. For success in the use of these crowns, it is important that an amalgam of great strength be used; for, with inferior amalgam, the permanent building up of badly disintegrated roots is impossible. Low grades of amalgam are also subject to discoloration, which may be apparent through the porcelain, and they are therefore objectionable.

Experience has satisfied me that the attachment of these crowns to roots with amalgam, and a pin whose surface will amalgamate, is the strongest method that can be used; and so great is my faith in it, that I take advantage of the mechanical principle in building contour fillings of amalgam in bicuspids and molars.

Cases will, however, present themselves when the articulation will not allow a porcelain crown of sufficient strength to be used. The inferior incisors and superior laterals frequently have roots so small as to prohibit the adoption of this method. For the roots of such teeth I prefer a platinum and iridium pin for the canal. A gold collar is made to fit around the root and beveled on the labial surface beyond the free margin of the gum. A gold plate soldered on the beveled surface of the collar makes a cap for the end of the root. Adjust the cap on the root, select a suitable plain plate tooth and back it with gold, fitting it upon the cap and attaching it with resin and wax. Remove the tooth and cap; invest and unite with solder. After polishing the piece, attach it to the root with oxyphosphate of zinc.

For the roots of bicuspids and molars, a very permanent crown can be adjusted by making a cylinder of gold to fit the root, and allowing a filling of amalgam to extend from within the root through the cylinder; using a composition pin to strengthen the attachment.

Gold crowns can be adjusted in the same manner as the porcelain crowns, and a beautiful operation can be made, the amalgam being entirely hidden from view. A crown of this description is made by taking a ribbon of coin gold, number twenty-eight American gauge,

and forming it into a cylinder shaped at one end to fit closely the root. An articulating face is made by taking a piece of gold plate, wider than the diameter of the cylinder, and placing upon it small, square pieces of gold, making pyramids according to the number of cusps required. The plate is held in the flame of a blowpipe, to solder the pieces together and to the plate, using an eighteen-carat solder. Now flow a solder of a lower carat upon the opposite side of the plate, place the cylinder upon it, and again hold in the flame until the solder reflows. The excess of gold is cut off, the cusps filed to their proper shape, the crown polished and filled with a plastic.

After the plastic has become hard, concave the base, drill the number of holes needed through the crown to its articulating face, and countersink the holes. The crown is now ready to be attached to the root. If, when adjusting the crown, any difficulty is experienced on account of the pins not adapting themselves, the holes can be made larger with a bur. After the crown is adjusted, the amalgam on the articulating face can be cut away and gold filled in its place, making to appearance an all-gold crown.

If a root be even with the gum, the gold can be made to encircle it. This is done in a very accurate and quick manner, by placing a soft steel wire, No. 27, around the root, and twisting the ends together until tight; then, burnishing the wire into the irregularities of the surface of the root, removing it and placing it on a block of soft but tough wood, and striking it with a flat hammer. You now have the exact counterpart of that portion of the root you wish to place the gold around. Gold crowns made and adjusted in this manner require about two hours' time, and necessitate but one appointment with the patient.

In presenting to you in the crude manner that I have to-night the subject of artificial crowns, I do not wish to convey the idea that any part of what I have described is original. I have only selected from different methods, as advanced by others, that which will meet the demands as they are presented by individual cases in practice.

Discussion.

Dr. E. H. Neall. I think that in the majority of cases it will be found to be true that the more readily the crown can be adapted the greater will be its usefulness. I strongly object to the great waste of tooth-bone that is made necessary by the use of many of the recent methods. For this reason I have used a great number of Logan crowns, which, after roughening the platinum pin, I attach with gutta-percha or oxyphosphate. I also use the Bonwill

crown, but give the preference to the "Logan," as it can be used without amalgam. In setting crowns, I do not usually trim the root down close to the margin of the gum, unless from the nature of the case the line of union between the root and crown will be very perceptible. When preparing to attach an all-gold crown, I take a cast of the corresponding tooth on the opposite side of the mouth; then after slight trimming make a metal die, and from this strike up the whole crown, which I make of foil-scraps melted up and rolled out to about No. 25 of the standard gauge. These all-gold crowns I have found very useful where the root is badly broken. A platinum pin is first cemented in the root, and the crown attached to pin and root by oxyphosphate.

Dr. Register. Has anyone present had any experience in making crowns by Matteson's method?

Dr. Darby. I do not think this method is generally used, though the results obtained from it in Dr. Matteson's hands show that it is a very good one. The Logan crown has this advantage, that the pin is burned in the porcelain; but the pin itself seems to be too small. It would be better, also, if it were not square. A platinum pin is easily stretched away from the porcelain in setting. With regard to the best material for attaching crowns to roots, my experience with amalgam more and more disinclines me to use it for that purpose. I prefer phosphate of zinc. All the pins set with amalgam which I have observed have given way. The amalgam seemed to rot them.

President Guilford. The Matteson crown is so formed in the stamping or pressing that it needs but little fitting to the root. After the crown is placed in position, its shell is nearly filled with amalgam or phosphate of zinc, which thus also surrounds and clings to the projecting root wire. A porcelain face is then ground to fit the labial opening in the crown, and dove-tailed on both sides and the cutting edge. This is then cemented in place, completing the work. The opposing tooth does not touch the porcelain, but only the gold shell.

Dr. Tees. My principal objection to the Logan crown is the difficulty of inserting the pin in the root, when gutta-percha is used, and this I consider the best substance for the purpose. By this method the pin and tooth must be heated, and that will cause discomfort to the patient. It is almost impossible to work oxyphosphate satisfactorily. If it is mixed too thin it will not harden well, and if too thick it will crumble. I think that with the Bonwill crowns made properly the profession would want nothing else; but they should not be set with amalgam. The pin which I have been using with most satisfaction is made from a piece of silver plate, No. 22, about one-sixteenth of an inch wide. I fill the root with

gutta-percha, and then warm the pin and place it in position. Then the crown is filled with oxyphosphate and pressed to place. When I cannot procure a Bonwill crown to suit, I use an old-fashioned pivot tooth.

Dr. Leech. I have had my best successes lately with the Bonwill crown. The failures I formerly encountered with it were, I think, in a measure my own fault. My greatest fault had been in using the amalgam too stiff. If you get the crown nicely adapted to the root, there will be no rocking,—an important gain, and one which will have very much to do with the final success of the operation. The labial portion of the crown should be carried as far under the gum as possible. The amalgam should be mixed rather soft; put some in the root; run an instrument up first, and then the pin, and see that it is firmly secured. Now try the crown on, and see if it is correct. Then put in more amalgam, packing it well in the root and around the pin; put some amalgam in the crown and push it well to place; and, finally, caution the patient to be careful of the tooth for a while, until the amalgam is firmly set. Proceeding in this way, you will find that the operation is permanent. As Dr. Darby has remarked, the amalgam will eat the pin off; but if you have a good adaptation, so that the crown will not rock on the root, you need not mind that; the amalgam itself will hold the crown in position. Do not have the amalgam too stiff in adjusting the crown. If it is too stiff the amalgam in the root and the amalgam in the crown will not join, but there will be a line of demarkation, and you will have nothing but the pin to depend on; but if the amalgam is mixed soft, and carefully worked up in the canal, so that there is one solid mass of amalgam in the root and in the crown, you will have a firm piece of work, even if the pin does give out.

Dr. Register. I have had poor success in setting the Bonwill crowns. One great error in setting crowns is generally committed in the initiatory steps. As a rule the root is not properly dried. Probably only a small minority of operators use hot air to dry the cavity; a precaution which, in my opinion, would go far towards insuring success. If, because of failure to thoroughly dry the cavity, we have a space between the root and the material for setting the crown, decay will follow, when, if the moisture had been dried from the devitalized wall, a hermetical joint could have been made. In one of the most successful operations I have ever performed the crown was put on originally as a temporary expedient. It was done in a hurry, about twelve years ago, for a lady who was preparing to take a European trip. The tooth was a labial incisor, and a small one at that, which had been broken off by a fall from a carriage. I took out the pulp, selected a thin plate tooth of proper

size and color, and a narrow piece of platinum, and riveted them together; and with a pair of pliers gave a twist to the backing; no solder was used. The root was dried out thoroughly *with hot air*, and the crown set with oxychloride (there was no oxyphosphate in those days). The backing was then cut away on the palatal surface, and filled in with gutta-percha, and the patient dismissed. After her return, I tried on three different occasions, without success, to get the tooth out, in order to make a permanent operation. About two years ago I filled it permanently at the back with amalgam. The success of this operation has caused me to set several crowns in a similar manner. A better post is made by having threads cut in two directions, right and left, on the pin; it gives the appearance of many points on the surface. I use on the marginal surface, before setting the crown, gutta-percha collodion, flowing a thin film of the preparation over the walls. This I also use over sensitive dentine, for the purpose of insulating fillings of metal; a film of the gutta-percha collodion, flowed over the cavity, prevents all thermal irritation, and renders the after-service much more comfortable. The film formed by the use of the gutta-percha collodion is due to the evaporation of the chloroform contained in the preparation. You can apply cold air to sensitive dentine treated with this preparation without discomfort. Of course, to make a positive union, the dentine must be dry; this can be positively done in a devitalized tooth, while in the living dentine it should be brought as near to that point as possible, without risk of destroying the fibrillæ.

Dr. Wood. I found that most of my failures in setting crowns with gutta-percha resulted from the pin being too small in proportion to the canal. I now use as large a pin as will allow for the necessary amount of gutta-percha to hold it. Before taking the impression I fit a piece of the pivot-wood into the root, as a gauge, so that when the impression is removed the pivot comes away as part of it; and when the cast is made the pivot is withdrawn from the cast, giving the exact size and angle of the canal in the root. When practicable, I sometimes plug the apical foramen with pivot-wood; I take a stick of prepared wood and taper it so as to closely fit the extremity of the canal, leaving it free of the walls in the larger part of the canal, to facilitate its removal, should that be necessary. After dipping the point in creasote I force it to place—having previously cut it at the proper distance—and twist the butt end off, so as not to interfere with the metal pin of the crown.

Dr. Essig. Fifteen years ago I used gutta-percha exclusively in setting pivot teeth, with good results as a rule, although occasional failure occurred, in consequence of the gutta-percha being over-

heated in setting the tooth. The variable quality of the gutta-percha furnished by dealers will also prevent uniform results in its use. I have, therefore, long since abandoned it for oxyphosphate of zinc, which requires neither force nor heat in its application; and is, therefore, less likely to incite periostitis. It is inferior to gutta-percha only in the difficulty of removing the pin, when the porcelain tooth is broken away, necessitating the use of a fine fissure-drill to cut away the cement from around the gold or platinum wire in order to obtain access to the canal.

Dr. Bonwill. Dr. Leech formerly laid his failures to the crown; now he attributes them to the manner in which he placed them upon the root. I am satisfied that the principle of setting the all-porcelain crown on the nut-and-bolt plan was perfectly correct; and that any one versed in mechanical principles would affirm its correctness. I have met men who had failed to get satisfactory results with these crowns, and on investigation found that they had not even read the directions, and had ignored the little details which go to make up success. I consider it foolish to attempt to adjust a crown with a pin fused in it. The method of mounting crowns described by Dr. Register is not new. Dr. How has done the same thing with his crown. I believe in amalgam, but I defy any man to pack it in the manner described by Dr. Register and Dr. How, so as to be cleanly. It will discolor. Not one dentist in five hundred can, with a tap, cut a perfect thread in wet dentine. In the matter of setting crowns you have got to come back to the principle which I have elaborated. They are the same that guide the engineer in his work. I have made crowns of amalgam in a few cases, where the teeth were quite short,—of course in the back part of the mouth,—and the amalgam has remained bright. Some failures have occurred in setting the all-porcelain crowns, because the crowns were not made by the manufacturers according to directions. With regard to the objection against amalgam urged by Dr. Darby, I would say that the pins were not "rotted" by the amalgam; I have tested that point thoroughly. It was foolish to put out three sizes of pins in the first place for setting the crowns; purchasers always got the smallest size, and of course they had failures.

Dr. Register. I think Dr. Bonwill is not consistent with regard to amalgam. Why does he make crowns of it, if it discolors?

Dr. Bonwill. If it is put in contact with another metal, it will discolor. When it is used for crowns, no other metal should be in contact with it.

The regular meeting was held Saturday evening April 4th, at the office of Dr. Joseph Pettit, 1624 Chestnut street, President Guilford in the chair. The following paper was read:

THE STUDY OF TOOTH DEVELOPMENT, WITH SPECIAL REFERENCE TO THE FORMATION OF ENAMEL.

BY HENRY BEATES, JR., M. D.

The first morphological manifestation of tooth development discernible is stated to be a proliferation of the superficial layer of epithelial cells constituting the epiblastic structure of the oral cavity which covers the mesoblastic structure or jaws, *i. e.*, tissues which will ultimately be the jaws, and a penetration, by the epiblastic columnar epithelium, of and into the mesoblastic element. This, it will be recognized, having occurred, has resulted in the formation of what we all understand as the "dentinal ridge" and "lamina." In order that each step described may be thoroughly comprehended by those not familiar with microscopy, diagramatic illustrations will be employed, and, for reasons which will be self-evident, the first illustration is taken from an embryo BEFORE dental morphology is established or perceptible. The section is prepared from the inferior maxilla, and cut in its horizontal plane. The diagram will illustrate only that portion concerned in our subject; consequently, the deeper ossific area and Mickel's cartilage will not be described.

Fig. I.

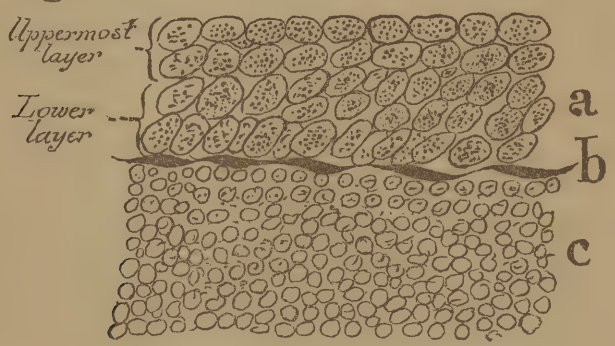


Fig. I.—*a* represents the mucous lining of the mouth. It is derived from the epiblast, and is, in type, epithelial; *b* is an extremely thin membrane, situated between the epiblastic structure, *a*, above, and the mesoblastic structure, *c*, below; *c* is the mesoblastic structure, and, in type, is of connective tissue order. An extremely important fact, which must be thoroughly understood at the outset, is that that portion repre-

sented at *a*, under a low power, closely simulates, in appearance, columnar epithelium. This delusion is dissipated by viewing the erroneously-denominated "columnar layer" with a one-fifth objective. In order that the origin of this almost universal error may be understood, a diagram (Fig. II.) of the same area of the section is sketched, representing the columnar-like appearance, as seen with the low-power objectives.

Fig. II.

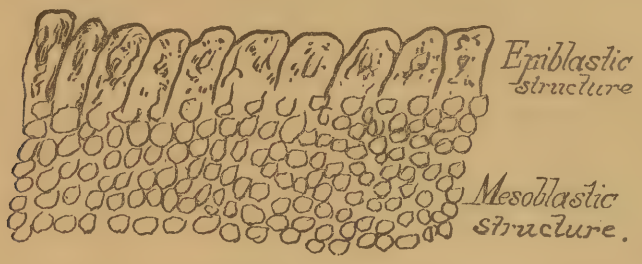
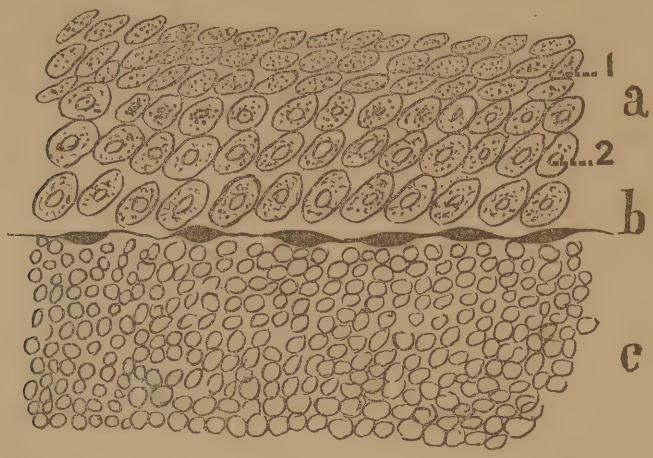


Fig. II.—It is to be noticed, in this diagram, that the basement membrane, as a separate anatomical element, is not discernible. I think, now, that a study of the section, under low and high powers, has rendered the true facts perfectly clear, and placed us in a position to proceed more intelligently with a closer analysis. Before proceeding further, reference is made to the fact that, from the appearance represented in diagram II., this special area is tacitly admitted to correspond with adult tissue, and, preferably, that of the cutaneous structure; but when we recall the appearance of the tissues with which we are dealing, as resolved by a high-power objective, and recollect that the cutaneous system possesses an epidermis, we are amazed to find that no structure analogous with the latter here exists. This brings us face to face with the demonstrable anatomical fact that embryonic structure and adult tissue are two very different elements. These facts being definitely understood, enable the statement *that there is no columnar layer of the epiblastic structure* to be comprehended, and the role played by this nonexistent structure *as described*, to be recognized as an error. Now view, carefully, in the section under the Wales' one-fifth, the epiblastic layer, and you can satisfy yourselves that what is indicated in diagram III. is a reality, viz., that there is a difference in the direction of the longer diameters of the epithelium occupying the uppermost position and that below.

Fig. III.—*a*, as before, represents the epiblastic layer; *b*, the basement membrane; *c*, the mesoblastic layer. The cells, situated above the plane, the lower level of which is differentiated by the line numbered 1, are seen to be somewhat more transverse than those situated below, and occupying the region measured off and numbered 2. This apparently insignificant feature is pregnant with important suggestion, as will

immediately be seen. Observe that the cells in area No. 2 are mononucleated, or, at least, the nuclei are more clearly seen than in the superimposed. Not to tire you with repetition, but that we may start right,

Fig. III.

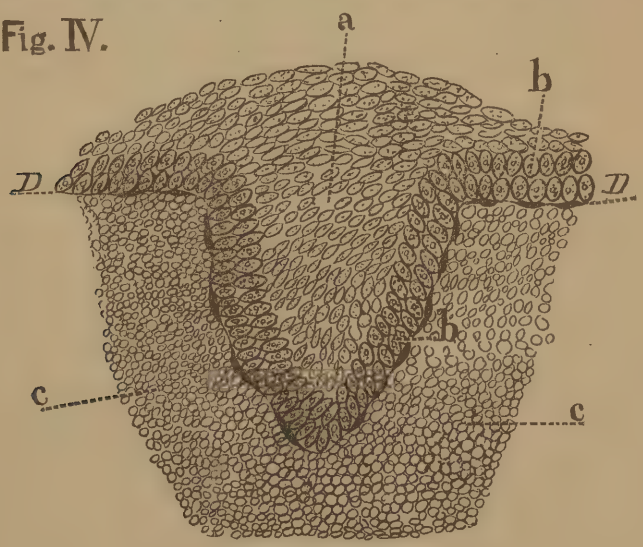


let us summarize and recall the facts thus far proven. First, we are concerned in the study of *embryonic* structure; second, there is no columnar layer; third, the erroneously-denominated columnar layer is an area composed of epithelial cells, which, by their relative arrangement, is subdivided into a superior and inferior zone; fourth, the inferior zone possesses cells, the nuclei of which are more distinct than those of the superior zone; fifth, the existence of a basement membrane.

Please bear in mind the characteristic feature of the epiblastic layer, for the superior zone will be concerned in the evolution of one element, the inferior another. We are now ready to proceed to examine the first morphological manifestations of tooth development.

Fig. IV. represents the dentinal ridge and lamina. You observe that

Fig. IV.



First evidence of tooth formation.

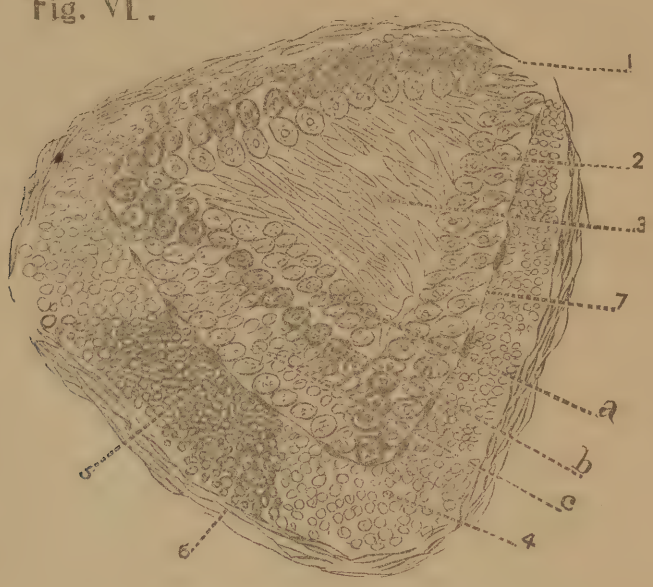
the cells composing the superior zone have undergone marked proliferation, and that the inferior zone has sunken into or penetrated the mesoblastic area; *a*, the lighter cells, are those derived from the superior; *b*, the darker, from the inferior zone of the epiblast; *c* is the mesoblastic area; *d*, the basement membrane. This V-shaped invasion of the mesoblastic region by the epiblastic layer is not at all a mechanical action, but one purely physiological. There is no limiting wall surrounding the embryonic jaw, which, when the proliferation of the cells of the superior epiblastic zone occurs, confines these cells and results in the squeezing down of the inferior zone into the mesoblastic region. The inferior zone coincidently penetrates the mesoblastic region, indeed the whole process is the result of obedience to the specific law, which governs each cell, and with which each element is endowed. The next noticeable step is the branching out, from an area of the V-shaped lamina of the so-called cord. As this is achieved, the zones manifest a trivial change, nevertheless a definite, demonstrable and undeniable change. The budding-out of the cord is represented in the diagram.

Fig. V.

1 is the "dentinal ridge" with the cells of the superior epiblastic zone, now *transverse*. This peculiarity involves the isthmus of the cord as far as the line *a*——*a*. 2 is the cord; 3 its expanding extremity; *b* the cells contained within the cord, derived from the *superior* epiblastic zone, but *not* having undergone the transverse change. The unlettered and unnumbered smaller cells represent the mesoblastic region. Note, particularly, the local functional activity manifested at 3 by the stirrup-like growth of the extremity of the cord. This is the result of special vital endowment possessed, more conspicuously, by those cells which occupy the position corresponding with the base. This devel-

opment dissipates all thoughts of a mechanical influence. A diagram representing a section of an embryo a few days older is now to be especially carefully studied, as the first morphological development bearing directly upon the facts determining the hypothesis to be submitted this evening, are manifest. As we are through with the lamina, and have to deal alone with the stirrup-shaped extremity of the cord and the mesoblast immediately surrounding, the adjacent structures are not sketched.

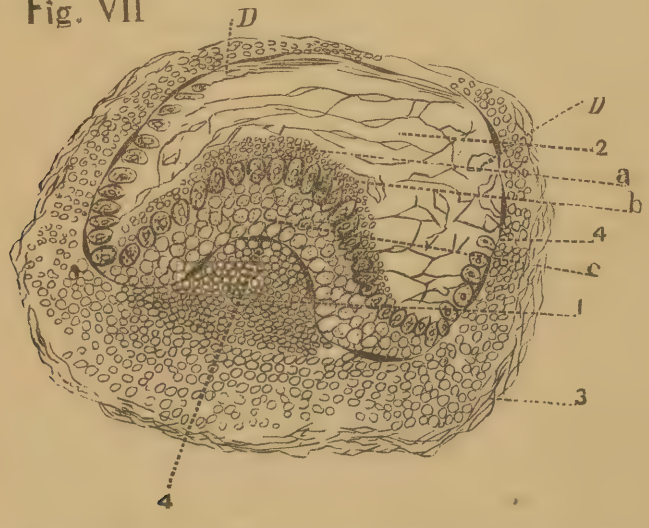
Fig. VI.



1 represents the obliteration of the neck of the cord and its seat of separation from the arm of the V-shaped lamina; 2, the stirrup-shaped development of the extremity of the cord; 3, the transverse cells, the incipient change prior to formation of reticulum; 4, the mesoblastic area and seat of development of dentinal bulb; 5, the more active area corresponding with seat of apex of future tooth; 6, sac of follicle; 7, basement membrane. Observe that this stirrup is composed of the *inferior* zone described under the first diagram, and the within cells, numbered 3, of the *superior* zone. The prime fact is that the base of the stirrup presents a manifestly different appearance from the sides or arms, only differentiated by a comparatively high-power objective, one-fifth or one-eighth. The special feature to which reference is made is that at the upper area of the base the cells are proliferating, and evince marked activity at a point corresponding with the situation of the future apex; that the central area is relatively inactive; that the inferior area, like the superior, is active. This is lettered respectively *a*, *b*, *c*. Thus, then, we have the base of the stirrup (and remember that it is derived from the *inferior zone* of the epiblast), assuming a trizonal area of special physiological activity. Under a half-inch objective this proliferating base pre-

sents itself as a simple thickening, which, from its apparently trivial appearance, has universally, I believe, been ignored, or probably regarded as an accidental condition, dependent upon manipulation. The remark may here be interpolated that the sac of the follicle, while more conspicuous at the base, does not develop alone at that point as a crescent-shaped cup, and then surround the follicle by an advancing growth of the cornua, but is the result of a fibroid connective tissue growth, located in the area of the mesoblast corresponding to the situation of the sac itself. Note, in passing, the aggregation of cells, in the mesoblastic area, at the situation of the apex of the future tooth. Remember, also, that when the adult tooth shall have been developed, the *base of the stirrup* will constitute the covering *from apex to neck.* What will become of the sides of the stirrup, and reticulum will eventually be made manifest. Summarizing, then, before we advance, it has been demonstrated—first, that the cord is derived directly from the epiblastic layer. Second, that its extremity develops into a stirrup-shaped element, the base and sides of which are derived from the inferior zone, and the central cells from the superior epiblastic zone. Third, that the base of the stirrup develops a trizonal area of special activity. Fourth, *that this trizonal area will be the covering of the future tooth from its apex to cervix.* Fifth, that the superior and inferior zones of this base are especially active. Sixth, that the middle zone is relatively passive. An older section introduces us to more advanced processes, enabling a tracing of the above facts clearly to be effected.

Fig. VII



The changes manifest are the mesoblastic formation of an apex, which is beginning to indent the base of the stirrup. This is shown at 1, and 2 indicates the position of the central cells, *i. e.*, those derived from the superior zone of the original mucous membrane or epiblastic covering, and their development into the reticulum. This latter is

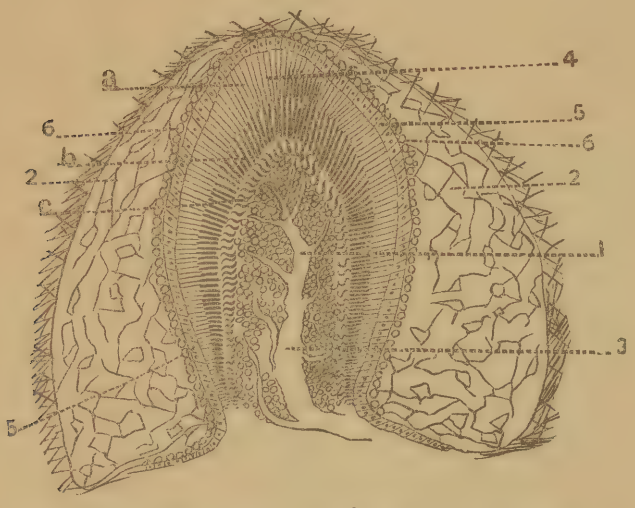
claimed to be the enamel organ, or, at least, its secreting element. 3 is the sac more advanced; 4 the basement membrane; *a*, *b* and *c* indicate the trizonal base of the stirrup. Observe that the inferior zone is especially developed, and will be the structure immediately superimposed upon the developed dentinal bulb in the adult tooth. Note that its "cellular quantity" is more appreciable at the apex, and that it diminishes progressively to the point which will be the neck of the tooth. The middle zone is of uniform thickness, being no deeper at apex than at cervix dentis. The superior zone is not particularly developed, and is simply distributed over the apex, being a little deeper at the latter situation. In the slides, and especially those of the progressive series, these facts can be substantiated for yourselves, and the diagramatic exaggerations which are necessary to impart a clear idea, while not so plainly seen, can, by everyone, be appreciated. At the locality *D*, the cells comprising the arms of the stirrup are undergoing atrophic change. You are now in possession of sufficient facts to permit of the description of sections considerably older. This is done to save time, as the intervening sections are to be studied at leisure, and the developmental stages most easily verified. The processes continuing are the development of the dentinal bulb, which pushes up the trizonal base of the stirrup, thereby separating the reticulum into two lateral, as it were, lobes, which are crescentic in contour, and applied to each side of the tooth, from apex to base, and the appearance of blood vessels which permeate the dentinal bulb in great number.

These vessels reach the extreme limits of the bulb, and serve as the tributaries which convey pabulum to this component element of the future tooth. The trizonal base has also undergone marked change, and, notably, the inferior zone. The superior zone is simply, as before, spread over the surface of the middle zone. The latter—and this must be especially studied—is now a genuine columnar layer of epithelium, of *uniform thickness from apex to cervix*, while the inferior zone is thickest at the apex and thinnest at the cervix. To revert to the dentinal bulb, we are impressed with the fact that, at its peripheral border, extending from cervix to apex, where, in earlier sections, rounded cells existed, there are now developed elongated cells, which possess polar prolongations, that enter into the area which will be occupied by future dentine. Note that, prior to the development of blood vessels in the dentinal bulb, *no specific developmental changes occurred, i. e.*, that there was not a trace of enamel, dentine or odontoblasts, but simply an arrangement of the cells into their respective positions, where they could most effectively elaborate the morphological functions with which they were endowed. Observe the relationship which the so-called secreting reticulum of the "enamel organ" bears

to the enamel; how, where the enamel will be thickest, the reticulum is thinnest; where enamel will be thinnest, the reticulum is thickest.

Fig. VIII. demonstrates the very marked change above noted. Fig. 1 indicates the bulbar growth; 2 and 2, the reticulum; 3, blood vessels of bulb; 4 is the inferior of trizonal base of the stirrup; 5, the middle zone, which maintains its uniform thickness from apex to cervix; 6 and 6, the superior zone spread over the middle, in a layer of thin cells; *a* is the enamel, *b* the dentine, *c* the odontoblasts represented by the S-shaped lines. The sac of the follicle is crudely illustrated by the X line. A few points for observation are to be noted: First. At the apex, where the enamel is developed the greatest, the reticulum is least. The significance of this is of two-fold force, when we recall the fact that this point will very soon penetrate the reticulum, and that the enamel, at this time, is *not*

Fig. VIII.



formed, but only beginning; that the enamel forms, or is completed, at a future time, *i. e.*, when the reticulum will have been situated near the base or root portion of the follicle. If the reticulum secretes enamel salts, how can enamel develop at a portion of the tooth remote from that reticulum? and why is the root of the tooth not covered with enamel, also? Second, where the enamel is thickest, the dentine and odontoblasts are also thickest. Third, that the partially-formed enamel is sufficient to cover a tooth of small dimensions. Fourth, that after this small tooth *has penetrated the reticulum*, the tooth and enamel continue to develop, *pari passu*, until the root extremity will have become obliterated, when the process of dental growth and development shall cease. Fifth, that enamel cuticle or "coronal cement is very attenuated in adult teeth of the diphiodonta," being of uniform thickness, and that the middle of the trizonal base is of this particular relative peculiarity. Again, if this middle zone constitutes the ameloblasts and elaborates the enamel from

the material supplied by a secretive function of the reticulum, why does not enamel be formed or deposited at that portion of the dentine, which will later develop and constitute the root, especially as this ameloblastic layer and reticulum, as will be seen in the older slides, occupy a position in immediate juxtaposition to the root? A study of an older slide, not to anticipate my hypothesis, discloses the fact that the inferior of the trizonal base, now decidedly developed, *ceases to exist at the cervix dentis.* When these facts are considered, the statement made early in the course of these remarks, that the inferior zone extended from apex to cervix dentis *only,* is seen to be full of significance, and explains why this trizonal area has been so carefully traced and identified throughout the study.

(Diagram IX. crudely represents the appearances manifested in an eight-month human fœtus.)

Fig. IX.

Fig. IX.—This latter is now seen. The reticulum is fully developed; maintains its original size and has not kept pace with the development of the tooth, and occupies a basal and root position. As the root develops and pushes the body of the tooth upward, the reticulum will occupy the position of the root and form the cementum. The line ⎯⎯ marks the point where enamel ceases to exist; 1 is the inferior zone, now well-developed enamel. Its apical development and steadily-diminishing thickness, until the point of cessation is reached, is conspicuous; 2 is the fully-developed reticulum, occupying, principally, the root region; 3 is the so-called ameloblastic layer; note its extension well below the enamel region and the relation of the reticulum; 4 represents the dentine and shows the relation of it to enamel; 5 is the odontoblastic layer;

6, the pulp. From this study, the theory regarding tooth-development, and especially the formation of enamel, may be formulated as follows, viz.: Teeth evolve from the epiblast and mesoblast; the enamel and cementum are derivatives of the epiblast; the dentine of the mesoblast. Enamel is evolved from the inferior zone of the trizonal base, above described. The inferior zone receives its material for elaboration from the pulp by means of the polar prolongations of the odontoblasts, which traverse the dentinal tubules, are in direct apposition, and, in many instances, continuous with the enamel rods.

I am indebted to Dr. Robert S. Ivy for excellent sections prepared from human embryos; Dr. W. Xavier Sudduth, for porcine and bovine sections, and Dr. M. H. Cryer, for specimens illustrative of dental development in rodents and various diphyodonts.

INCIDENTS OF PRACTICE.

Dr. James Truman. I would like to inquire if any gentleman has had any success in the use of cocaine, in treating sensitive dentine.

Dr. George Roberts. In one instance I took the crystals and mixed them with water on paper, and placed the solution in the cavity, and allowed it to remain for five or ten minutes. The patient was entirely relieved from pain while excavating the cavity. I regard it as entirely worthless in many cases, owing, perhaps, to our want of knowledge in properly applying it.

Dr. E. H. Neall. I have tried a four per cent. solution of hydrochlorate of cocaine in three cases of extra-sensitive dentine, in only one of which I had but partial success.

My method has been to apply the dam, and, after thoroughly drying the cavity, first with bibulous paper, and then with the hot-air syringe, to saturate a pledget of cotton with the agent, and place in the cavity of the tooth, allowing it to remain from six to ten minutes before attempting to excavate.

My experience has been so limited, and the amount of success so small, that I have very little faith in its being of much use as an obtunder of sensitive dentine.

Dr. Joseph Pettit. I have used cocaine for several months, and the results obtained do not permit me to agree with those gentlemen who pronounce it a total failure. Whenever practicable, I have used it in the teeth of those patients who were sufficiently well informed to give an intelligent opinion as to how much, if any, benefit in the way of decrease of sensitiveness followed its application. In some cases I have excavated exceedingly sensitive teeth without any pain whatever, and in probably nearly as many there has little or no benefit followed. If, how-

ever, I am able to reduce or prevent pain in but half the teeth to which it is applied, the remedy is too valuable to condemn.

I find it an excellent plan to apply the four per cent. solution to the gum after it has been blistered by counter-irritants in the treatment of periostitis. Its soothing and healing properties are immediately apparent.

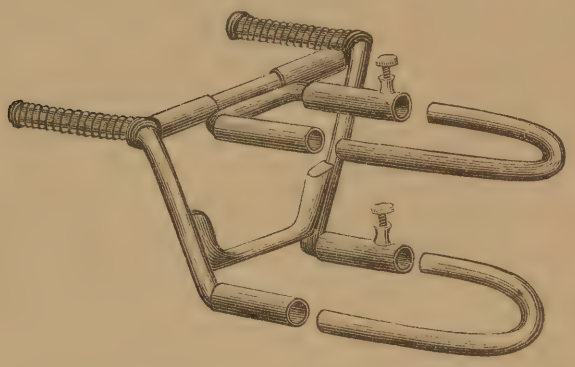
Dr. M. L. Long. I have succeeded in obtunding the sensitiveness in a number of cases where the decay was near the margin of the gum, but in cavities in other situations my experience with cocaine has not been very favorable.

Dr. James Truman. My experience has been comparatively limited, but I have had no success. It has been introduced in the clinic at the University of Pennsylvania. I had it used hypodermically in extraction with scarcely any pain, but in the treatment of sensitive dentine there has been no success. I question whether it will ever be of any value for sensitive tissue. With hypodermic injections I think we shall, probably, be enabled to fill some teeth without pain. The after-results of this treatment are as yet problematical.

The regular meeting was held June 6th, 1885, at the office of Dr. Bonwill, 1721 Locust street, President Darby in the chair. The following paper was read:

GEOMETRICAL AND MECHANICAL LAWS OF ARTICULATION. ANATOMICAL ARTICULATION.

BY W. G. A. BONWILL, D. D. S.



Although I have been invited to read you an essay upon this subject, I do so with reluctance, from the fact that it has been quite twenty-six years since I first discovered the Law and applied it to the needs of dentistry; and during this time have never been asked, until now, by any Society to read a paper thereon.

I can well conceive, however, a reason, and believe it to be from the apathy and repugnance of the modern dentist to mechanical dentistry. Not because he is so perfect in the art of preservation of the teeth, but from an idea born illegitimately, "*it is not so professional.*" This is well, if it could blot out the need; until then, all of us should do what we can to elevate it by making use of every appliance that shows merit. The action of quite every society of cutting off discussions on such topics by "voting for the next subject on the programme," is enough to crush out the spirit from those who have ability in this branch. Be it said to the credit of many dentists, I have been asked to write up and place the apparatus on the market.

It was not patented but presented to the profession as soon as I had completed and proven it, I made one effort to place it on the market, but as soon as it was found to fill the place of what would have brought greater profit to the dealer it was tabled at once, and this one which I obtained of a dealer was patented by the party, supposing the same principles were embodied; but, being ignorant of anatomy and the geometrical law involved, it was "still-born."

This action very much disgusted me, and I saw no chance to do my

duty to you except by my own private enterprise, running the risk of losing all I might advance. I am sorry to say there are many good things that are thus crushed by the dealer and manufacturer unless they can have their way.

I have thought it but due to mention these facts to vindicate myself against any charge of selfishness for withholding this "Anatomical Articulator," which forms the basis of my essay; and, in my own opinion, is not the least of what I have endeavored to do for you.

After more than thirty years of active life in dentistry, I am fully persuaded that of all that constitutes dentistry proper, the mechanical forms the basis. And yet, to make anything that is beautiful in our Art, especialy in vieing with Nature in matching the teeth, we must be more than mere mechanics, more than capable of filling a tooth or treating an abscess; we must be dental artists. When we come to place in a set of teeth upon which depends so largely the expression of the face, from the soul beneath, we must bring to our aid, not only the laws of mechanics and geometry, but the beauties of Art. It is not enough that we accurately adapt the plate to the gums: that we so grind the teeth to the plate as so be water-tight; that we so make every joint that it cannot be distinguished; that we so polish the plate over symmetrical curves, that the tongue cannot find the least fault; we must do something besides this; we must impart *action* to these otherwise whited sepulchres; we must instil life therein, or our labor will be in vain. A tooth may be elegantly shaped and colored, yet if it lacks the proper shape for the person for whom it is intended and is unskillfully set in the arch, it is a failure. The blocks from the same mould set by different operators, may vary in effects in every case. To get proper effects you should have a number of blocks of the various shapes, colors and sizes and try them under the lips until your judgment tells you which to use. Your taste can be so cultivated that you will be apt to criticise your own selections.

I shall use the term articulation instead of occlusion, for the very good reason that it is more in keeping with the functions or the motions of the jaw. If there was but one movement to the lower jaw, and that up and down, we might possibly say occlusion. But this latter term applies more properly to the shutting the lips or closing the mouth, and not to the motion of the lower jaw dependent on the articulation of the same at the Glenoid cavity, where the articulation is universal. Articulation is a word of action throughout, while occlusion answers to the mere act of closing the teeth and lips and keeping them closed; one is active, the other passive. Before we can comprehend then what constitutes true articulation of artificial teeth, we must look at the anatomy of the human jaw and its functions.

We find from twenty-eight to thirty-two teeth in each jaw, arranged in such manner that no two strike directly against each other, but antagonizing in such a manner as to prevent the whole denture from becoming very irregular, which would be the case if striking one against another. By this arrangement, when one tooth is lost, the regularity of the arch is not interfered with. As necessary as this is in nature, it is not positively necessary to follow it in artificial work, although for the sake of harmony it should be done.

It will be found in 95 per cent. of cases that the upper teeth project over the lower, and the depth of overbite varies as the depth of the cusps of the bicuspids are deep or shallow; and the ramus will be found to come upward and backward in relative proportion to the length of the cusps and the overbite.

One point of very great importance has not been lain down in general or special anatomy—the peculiar tripod arrangement of the lower jaw forming an equilateral triangle.

From the centre of one condyloid process to the other, four (4) inches is about the average; and it will be found that from this same centre of the condyloid process to the median line at the point where the inferior centrals touch at the cutting edge, is also four (4) inches. It is strange it should have been overlooked; but it only shows, when studied in a geometrical and mechanical sense, the great wisdom in our formation. It varies slightly, but never more than about one-fourth of an inch, which would make but a trifling difference in describing the arc of a circle. You will perceive that in setting your artificial teeth a one-fourth inch the radius of the circle would not materially alter the articulation. Without such an arrangement the teeth would have to be flat on their grinding surfaces to admit of lateral movement. Besides, you would not have the beautiful and wise curvature at the ramus, for equalizing the force applied to the teeth in all directions.

Imagine the human jaw jointed at the pharynx, or as you see in the ordinary brass articulators. Do you suppose that there would be any greater wisdom displayed in such hinging or articulating a part destined to such varying motions and powerful wrenching force? No! The study of this one part of the head and jaws shows one of the most striking designs of a Great First Cause; and, when studied, you will see that every part of our frame is made by a positive law and to subserve definite purposes; such law being in consonance with geometry and physics and mechanics. We must see the true use or function of the jaw and the teeth, and the food destined for us, and how it should be comminuted; there is no chance work about it! There is law and order pervading every part; the jaw forms a perfect triangle, for the purpose of bringing

into contact the largest amount of grinding surface of the bicuspids and molars, and, at the same time, to have the incisors all come into action during these lateral movements.

You will also find that from the cuspids, the bicuspids and molars run in nearly a straight line instead of a curved one back towards the condyloid process, enabling them to keep the largest amount of surface always presented for mastication. Another thing which has never been explained by anatomists or naturalists, is the law of the normal relation of the upper to the lower incisors. The normal jaw should overjet and also have a corresponding underbite. Without such a law the incisors would lose largely their functions, that of incising on the principle of a pair of scissors. Where the incisors strike directly upon each other, the power to cut off food is very much lessened. The length of cusp of bicuspids and molars prove the law.

Another unobserved fact and law will hold good. Where there is an overbite and underbite, just in proportion to their depth will be the length of the cusps of the cuspids, bicuspids and molars. By drawing two lines from a common centre, answering to the condyloid joint, to the centre of the lower jaw at the incisors, four (4) inches distant, the distance between the lines grows less as you go from A to B, the centre of motion; and if the depth of bite is an eighth of an inch, then when you come to the bicuspids, the cusps are shorter and the molars still less; and, if there were any teeth at the condyloid process there would be no depth of cusps. So that when you see a first superior bicuspid you can very well tell from the length of the cusps whether the jaw from which it came had a depth of underbite of one-sixteenth or one-fourth of an inch. Where the teeth all strike fairly one upon the other and no overbite, then you have no occasion for cusps. And if originally there, but a flat surface they would soon be worn off from the abnormal articulation.

Another unobserved fact in connection with the law of articulation: when there is an underbite there will always be a corresponding curvature of the lower jaw at the ramus, the upper jaw corresponding to it. This provision of articulation is most wise, carrying out still more fully the exact law by which the anatomical movements of the lower jaw for perfect mastication is governed. So beautiful and so mathematical a design cannot but call forth our admiration and wonder; and the study of no other part of the human body will give one a clearer idea of infinite wisdom. This movement we will find in the artificial sets arranged upon this law. In the natural the incisors are really the first to be arranged; though the first molars emerge first, to assist in the more perfect mastication of food and to keep the jaws at the proper distance. The incisors show a definite fixedness of purpose to arrange themselves after their typal shape, and to

form the overjet and overbite at a given depth, for the accommodation of the bicuspids and molars which are soon to appear, having cuspids of a definite length, so that the law of articulation which has been premeditated to a certain typal shape and construction, be carried out. Then, if the general law, which holds good in 95 per cent. of the cases, is followed —if the underbite is one-fourth of an inch at the incisors—the teeth posterior to the cuspids will have a depth of cusp shorter in proportion to the *underbite* of the *incisors*, as they go backward toward the centre of motion at the condyloid process.

You will also find that the grinding surfaces of the bicuspids and molars have a typal shape—allowing them to meet with all their surfaces touching —for an express purpose, after a preordained and established law, from which the greatest area is gained for mastication; and that the inner cusps of the lower teeth are as necessary as the outer of the superior, when laterally moved. The law is still further carried out in the curvature at the ramus, from the second bicuspid to the third molar, to permit of all the surfaces on one side to be in contact, while the other unused side is only partially so. The nearly straight line of arrangement from the cuspids to the last molar is also in keeping with the underbite. You may well ask, just here, "will this law hold good in an artificial articulator such as I use, applied to setting of artificial teeth?" As soon as you once attempt to apply this principle you must certainly grasp this law, so wise and beautiful. You may have varieties or forms, but the general law will hold good, and where there has been much latitude or varying from it by abnormal mixtures of races or types, if nature is given a fair chance to right herself, she will return to the normal standard of mathematical and mechanical precision; to do otherwise would annihilate creation. Cells free to arrange themselves must develop the original creation, and perpetuate and keep it to the perfect standard, by selecting the highest type of perfection in shape, strength, beauty, etc.

I must be pardoned just here for deviating from the original to introduce some new thoughts in close relation to the subject. Were it not that a law or system is at the beginning before a creative act, that is in unison with an end, there could be no fixedness of purpose or result in propagating life. There must be a type or specified shape, which must run through all life, most beautifully exemplified in mechanics in making all parts interchangeable. The cell must have a specific power to reproduce and perpetuate itself to all infinity, being as perfect as in the beginning, after the law was ordained and promulgated. No known organism has changed its number of cells, their function or power; nothing has been added and nothing obliterated; and the same law holds good in their combination for building up an organism and establishing a

type; and although it may be interfered with by injudicious and ignorant mixing of the races, yet there is a certain limit when life is forfeited and nature commences anew from the same stand-point of law and order. If I am correct in this I must necessarily run counter to the Darwinian theory, that nature is from age to age making a "fitter type," and that we are only a more perfected change and type of the chimpanzee. The law was absolute perfection in the beginning, and when organization and types are seemingly changed, it is only for the moment; they must go backward, and not forward, to reach normality, otherwise all life would have long since become extinct. Environment effects only superficial change in minor exterior points, but cannot annihilate or change the organism or type. If it were true what deformities in the teeth would occur, if their shapes and arrangement in middle and old age could be fixed upon posterity. I can readily see where the early extraction of the teeth will affect the posterity, not in changing their type, but in diverting nutrition from this region, until nature fails to supply the organs with pabulum for their healthy organization, thus becoming so weak that caries is inevitable. We may extract as many as we please, and even early in life, but it will have this effect only; and at no time, however remotely could the eruption be prevented, as nature would not tolerate a congenitally toothless man to live and perpetuate his progeny. He would be so far retrograded, that without the organs of mastication, food could not be so prepared, that "life would be worth living." Man may apparently change from disobedience to law, but the penalty must be paid ultimately.

We have this law well illustrated, in the growth of the hair; if cut too often in early life, and kept so, nature will supply enough material only for such short growth, and resist any attempt to make it grow longer. Were we for a generation to remove one of the kidneys, if it could be possible, and maintain life, nature would go on making two kidneys, but weaker ones, until the family would become extinct altogether from imperfect nutrition, as in the growth of hair.

Could you but stand beside me while I arrange a set of teeth in this articulator, you must become converted to my system as founded on law and not on chance. There is no other part of the human body that will permit of thus handling and unfolding, and again rearranging. No other that stands outside its own organic workings that will permit such demonstration. It is the key to the revelation of nature's inner workings, and unfolds, without a *missing link*, what we were, absolutely perfect in cell and organism for the inception, and simply in conformity to an infinite and allwise law which cannot be blotted out. The teeth, individually, have been a great factor in science; and when they can be looked at from the point of view herein laid down and hitherto undeveloped, their signifi-

cance will be magnified; and if we, as dentists, but take up the work as only belonging to our specialty, and scientifically prosecute it, our honors and standing will be enhanced.

Let me repeat the points which I claim as guides for the setting of artificial teeth, being after the study of human anatomy:

First. The human jaw forms an equilateral triangle. Taking the base from condyle to condyle (the centre of each), which averages four inches, the other arms of the triangle run from the condyle to the median line of the incisors of the lower jaw, also four inches long. This, I say, is not laid down in any anatomy.

Second. That in ninety-five per cent. of the cases of the upper jaw projects over the lower, and the depth of underbite varies from three-eighths of an inch to a sixteenth, and that but about five per cent. of articulations have the incisors to come directly in union, which is the law of exception or abnormality.

Third. The ramus of the lower jaw has a definite curvature answering to the depth of the underbite, and the cusps of the bicuspids and molars correspond in length to that underbite, and all preordained from the type to be organized.

Fourth. The arch, instead of being of horse shoe shape as in artificial dentures generally, the teeth forming the abatments of the arch, running from the cuspids on either side, look almost directly in a straight line to the centre of the condyloid process. The arch should not be contracted at the molars.

Fifth. The teeth grow out of the arches to a definite length or point, and no further without a mechanical irritation is set up about the investing membrane.

Sixth. The specific shape of the inner and outer cusps of the bicuspids and molars are not without design, and go to establish the perfection of the law.

Upon these bases I shall found the science of articulation, and apply it to the arrangement of all artificial substitutes, changing to suit individual peculiarities. The query here naturally arises to those who have never looked into the philosophy of this matter, whether these peculiarities are necessary, and if it is possible to utilize them in our artificial dentures? and, if so, how can it be done by any of the articulators now in the market, or can it be done at all by any human device? To all these inquiries I answer in the affirmative.

As to the necessity, it should need no argument to convince you that an artificial denture should correspond to the natural one in every respect as nearly as can be approached. It may be a question with you how nearly art and mechanics can imitate the natural movements and expressions.

Has there ever been any rule heretofore given by which you can regulate your beginning and ending with any kind of design? Have you any chart, system or plan to go upon, such as the plot or sketches by which an architect, artist or sculptor can bring forth his ideal? No! I say most emphatically. Look at all the sets of teeth made, I care not from whose hands they come, and you will not find one made after any special law to suit the individual case. Not that no sets have ever been made that have not been serviceable or look well, or where no taste has been manifested; I have seen many, but how much more useful and life-like they can be made by following the system as found in the natural jaw. I remarked it is so strange that these points should have been overlooked so long. To have examined the human jaw critically would have led to the plan at once. But we have acted on the principle that artificial teeth can only admit of the up and down or hinge-like movement. To allow of the lateral motion is thought to be impracticable, as it would throw or upset them, and render them difficult to keep in place. The regular horse-shoe shape has been adhered to up to the present, for fear that if the molars were placed outside the arch, the plate would tilt, and mastication be impossible. To give to the teeth the greatest advantage, you are taught by some to let the cutting edges of the incisors meet squarely, and have no overbite. If there has to be overbite, then the arch must be so large and wide, more than normal.

You are taught that it is vandalism to grind the antagonizing surfaces of teeth, as if there was but one magnate to see them, the manufacturer of the teeth. You are also taught that but one side or cusp of the bicuspids and molars can be made to antagonize the outer. As I have studied the matter in its manifold bearings, and as my fort is in mechanics, I speak as having authority; and, if practice is of any value in establishing theory, I am prepared to give it to you in various ways, and attest that the adaptation of such work in the mouth holds good to the law as it does in this articulator I now present. So that when you have fitted in this device on the law laid down here, a set of teeth for any jaw, you can rely upon it, that if you had the jaw itself in your hands, you could not approach more nearly to what is demanded. In some cases there is need of touching a cusp here and there, but to a very trifling amount.

Let me enter, then, upon the merits of this anatomical articulator and the plan of setting teeth by its use I told you that it was founded upon the measurement and movements of the human jaw. The distance from centre to centre of the condyloid process you will find is about four inches, the same from the condyles to the median line in the lower jaw at the top of the cutting edge of central incisors. This, with

the up and down and lateral movements constitute the mechanical construction of the human jaw. This you must observe is a fixed principle, and it is easily seen why this form of a triangle has been adopted in man. This triangle can only be found within a perfect circle in which you have the greatest breadth and area of surface. No other geometrical angle would have given such perfect beauty and symmetry to the face. The compactness brings the largest number of teeth nearest the centre of motion. The double joint permits the greatest strength and the easiest lateral movement with the greatest range of this at the least expense of power and compass. It permits the largest number of teeth to antagonize at every movement, and not least of all this very triangle is the means by which nature develops the typal shape of the ramus, and of the formation of the jaws, the underbite, etc.

It will be observed, that in making the lateral movement of the lower jaw to the left, that the condyle of the left side stands still or does not move backward, it merely revolves or rotates in its socket, which is but a trifle. The right condoyle moves forward in the glenoid cavity fully half an inch, when at its farthest limit, causing the outer cusps of the upper, from the centrals to the last molar, to touch the outer and inner or buccal and lingual cusps of the lower on same side—the left—and on the opposite side—the right—we find only the inner cusps of the bicuspids and molars of the upper, to come in contact with the outer of the lower, and the centrals to the cuspids do not touch. And why so little surface touching on right side when the lower jaw is thrown to the left? You cannot masticate on more than one side at once, and when you throw the jaw to the left in the act of masticating, the food is upon that side, hence there is no necessity for the right side to have so much surface in contact. But why should it touch at all on the right? In order that the muscles of both sides should act equally, which could not be done if the teeth were not allowed to strike there, giving support to that side of the jaw, and equalizing the force brought to bear upon that side, although no food be there. If there were no touching of the teeth on that side while mastication is going on upon the left side, there would result, as a sequence, that peculiar movement of the lower jaw at the condyloid process, which makes it difficult to place in teeth for the aged or those even in early life, who have lost all the grinders on one side.

This form of triangle is necessary again for the purpose of giving the largest number of muscles a chance to act on both sides simultaneously and concentratedly, and thereby keeping the circle or arch of grinders down to their work, and equalizing the pressure on all sides. It enables the teeth on the side where the chewing is being done to arrange themselves when erupting, that they will be very nearly in a line with the left

condyle, which is now passive on this side, and forms one point of the dividers in forming the arc of a circle; and by this condyle being where it is—four inches from the other—the molars and bicuspids, as well as the central of that side, all come into the most perfect contact, for chewing and incising, thereby carrying out this absolute natural law of the perfect adaptation of geometry and mechanics to her uses, and having no lost motion or function in any part.

Again, the triangle gives us an extra motion forward, which brings the lower teeth in contact with the upper to incise or cut off food presented there. This could not have been with any other arrangement than the triangle. One central point at the pharynx or on the median line would have been a single swivel joint, and have brought the teeth across each other in such a way that as soon as any lateral movement commenced, they would be drawn away from each other very rapidly, and but little surface be in contact. This triangle will enable you to get just the exact depth of underbite from the incisors to the last molar, and the exact shape of arches; and particularly that of the ramus, which is not a matter of chance—neither is the length of cusps on the bicuspids and molars mere chance. The type has been preordained, just as the nose on your face, or the peculiar shape of the eye, or any other one part of the body. And you will find that where a superior bicuspid has a cusp of a given length, the overbite will be governed and ruled by it. It cannot be otherwise. If in the arrangement of the teeth in the human jaw no type or design were laid down in conception or embryonic life, what malformed creatures we should be mentally and physically. And you will find that just in proportion as there is congenital insanity, or want of will or directing power, there will be a malformation of the teeth and their arrangement.

So much for the rationale of this triangular arrangement. You can only truly comprehend its beauties by studying this matter closely. The next step is, now that we know the exact shape of the jaw and its philosophy of form and functions, we must have at our command something so nearly approaching it, that we can place our models upon it, and thus again restore nature's "Lost Art." I believe I have it here so nearly that it will be found to answer our most fastidious notions of setting by a system, teeth on plate. In addition to the anatomy of the human jaw, I have it so arranged that with one base you can articulate any number of sets, or partial sets, without destroying the original plaster bite. The rings —or bows rather—are adjusted to the upper and lower sections or jaws of the articulator, and passed out or in, at pleasure, without even interfering with each other. The case can be grooved on in a year after as well as now, if the bows of the case are marked and preserved; and the

economy of it is very marked, for two bows will not cost so much as another articulator; and besides are so cheap that they can be thrown away much easier than a more costly articulator. The whole apparatus is made of wire, giving you a clear view of every part within the arch, for the perfect articulation of the inner cusps; you will observe it has no set screw to hold the jaws apart, nor any device by which you can arrange the bite in the articulator. There is no room for guess work in rearing an artificial denture.

Before placing the wax models in the articulator, it will not be out of place to say a word about this arrangement of the wax on the base plate, and the selection of teeth in full sets. Always model the upper wax first, judging of the length of incisors by the trial of an artificial tooth in the mouth, such as in shape, length and width, as would look natural and appropriate, when held under the lip. This will enable you to get the height of wax and the contour after successful trial. The modelling of the wax on the upper plate is not arbitrary or fixed, so far as a definite law is concerned, in being able to work after a set pattern; here the true dental artist comes in. You get the length by trial of several blocks or single gum or plain teeth, as may be, as well as shade of same. As to the arch of upper you must add to and take from, making depressions, etc., until your judgment tells you it is correct. To aid amazingly in this work of art, draw out the patient in a smile or broad convulsive laugh, compel him to do so; nothing tends so to relax most universally every muscle and give true expression to the countenance. If the wax is not in keeping with symmetry you will see where the trouble lies. Look at them in front and on either side when they are laughing as a sculptor would upon his model. Be sure that the arch at the cuspids that form a double keystone to the arch stand out more prominently than any others. The superior first bicuspid should nearly always fall back somewhat behind the cuspids.

Now that the upper wax is correct the same rule applies to the lower. It is easy to make this conform to the upper; you may have to change the upper in some respects when tried with the lower, but not much. The length of wax at the molars may have to be trimmed to allow of equalizing the length of the teeth on upper and lower plates. Laughing and smiling will here again tell. Be sure to mark the centre at the median line, making marks or grooves through on either side, running from upper to lower for guide; they can be removed and are now ready for the articulator, with the bows pushed into their sockets in the base, which are retained by mere friction. The plaster models or casts with the wax articulation or bite thereon—and all fastened together by wax or cement to prevent being displaced from the cast—are now placed on this lower

bow of the articulator, and the upper bow brought over upon the upper cast. Your eye soon detects whether the median line or wax is in the centre. To get the cast in proper place, have a pair of calipers four inches between points, and by it place the cast in position, with centre of lower teeth just four inches from the condyles on either side. Hold in position, while with plaster you secure the upper to the bow, and when hard the lower bow to the plaster cast in the same way.

You may ask where is the set screw to hold open the jaws of articulation after wax is taken off? I have never found it necessary in this kind of frame. Before taking off the wax, I take a pair of dividers, or a piece of wire bent with the points about one inch and a half apart, and mark, with one foot on plaster cast, and the other at cutting edge of wax, the bite at the median line. Do this for both jaws. To secure this height for future repairs, mark on each cast with the dividers, the distance apart or width of dividers, and this will always be your guide for height. Take off all the upper wax—except a section at the molars—first and let the lower remain as a guide, for the arch of the upper. The first block or tooth fitted on the upper when backed with wax, answers perfectly to keep the jaws of the articulator apart. The set screw would be in the way with the lateral movements. I stated that the length or depth of underbite in full sets, is restricted to the width of the jaws and length of the centrals, which it is presumed have been selected to suit the individual case. Knowing how much the underbite is to be, you can very nearly guess how much to cut out the bicuspids and molars on all the grinding surfaces, before any of them are fastened to the base plate, and how much arch upward at the ramus, from the second bicuspid backward and upward. If the underbite at the centrals is to be an eighth of an inch, then the bicuspids in the upper will have grooves between the cusps not quite so deep, and the molars still less. From the cuspids, then the cusps are less to the second molar; were the incisors to strike equally and directly on each other, there could be no cusps or would be of no use. The inner cusps of the upper should as a general rule be longer or higher than the outer. The outer cusp is more acute, the inner rounded. The lower the reverse—inner sharper and outer rounded, where the upper closes over the lower. For full sets you need but slight underbite, only enough to permit the lower to come forward and act as shears for cutting; at the same time it permits of cusps to both bicuspids and molars, and gives all, double amount of grinding surface; there being cusps that touch on palatal and lingual sides, at same time as the buccal. Always bear in mind that the curvature upwards at the ramus, of the upper set, is always in proportion to the underbite.

If for an upper set alone, you can tell how much the upper incisors should

overbite, by looking at the curvature of lower molar teeth remaining. If an eighth of an inch out of line, the overbite should be fully so. This, when once understood, can give no trouble. The grooves in bicuspids and molars will form with the cusps buccal and lingual, an o. g. as seen in cut, to give double the grinding surface when worked laterally; besides giving double cutting edges. All these grooves can be cut out before any are fastened with wax, so nearly that but little touching will be needed when the lower is articulated to upper. The first bicuspid in the lower jaw should have but one cusp. This perfect design will be seen in the articulator why it should have but one. Two would not only be in the way of the tongue, but be of no use. Be sure that the groove in the upper is made nearer the buccal side, and for the lower or lingual side, for a reason which you will presently have explained. Now that the grooves are completed in the upper and all the teeth in place in the arch, we will articulate the teeth on the lower base. The height is soon ascertained by the dividers, and the central incisors tried on to see what changes will be needed. Fasten it temporarily with wax, and try it with the lateral motion and the points adjusted to meet all the surface on palatal side of upper teeth, when the lower is thrown to the side of the tooth being fitted. Cut from the cutting surfaces of each, whichever will make the most natural and strongest case. If for a very young subject be careful, but for a middle aged or elderly person do not scruple about the cutting edge and grinding surfaces, but sacrifice even the labial or palatal surface, for the sake of effect and usefulness.

I sometimes turn the buccal side of a molar inward, to save substance and get effect and for better adjustment; frequently for want of room at ramus I do this; and, occasionally turn buccal side upwards, for the grinding surface. If using blocks before the front ones are fastened securely to the base plate, and while they are temporarily in their right place, try the bicuspid blocks, to find out how much of the joint should come off of the incisors or the bicuspid block; or divide it. This will secure a better and more continuous joint, and give the lower better chance to be arranged to the upper. Before taking off too much of the joint of either of these blocks, try the lower incisor and bicuspid block temporarily on wax, to know where the cusps are going to come. Regulate the joints by this. You can make the groove in the lower blocks the reverse of the upper, and cut them all out before much jointing is done, taking care that the groove is now on the lingual side and that the buccal cusps are rounded, and the inner more acute as in the buccal of the upper. Never cut off any of the lingual cusps of the lower bicuspid and molar, such as are now made, as they are universally too short, and to get them long

enough for service a large portion of the buccal cusps have to be cut down and rounded.

The inner cusps of the upper strike between the outer and inner of the lower, and, at the same time, these cusps should be long enough to allow in the lateral movement, the incisors and cuspid on that same side, to touch simultaneously all the surface from the central to the last molar. If they do not, then your remedy is to make the groove deeper in both upper and lower, or perhaps the lower only, or the upper only. Experience here will soon teach you which. When you have all the cusps touching inner and outer, and the front one, take the opposite bicuspid and do likewise; and with the additional precaution when the lower jaw of the articulator is turned to the left, to make the inner cusps of the upper, strike the outer cusps of the lower, and vice versa, when thrown to the lateral right or left. The molars must have the same rule applied, with yet another additional point of great importance.

The curvature of the ramus must be made to conform to the depth of overbite, so that when the lower jaw is thrown to the right, the outer and inner cusps of both upper and lower sets on that side come together at the same time that the bicuspids and incisors do; but the curvature should be great enough to permit on the opposite side of the second molar tooth in the lower, which slides forward to meet the first molar in the upper, apparently moving backward. If they were on a plane, they would never touch, on account of the jaws opening as they move laterally to the right or left; to mount up on the cusps of the incisors, an eighth of an inch, which would not allow the molars to touch, if on a straight line backward. But inasmuch as on the plane of grinding surface the first upper molar stands higher in the upper plane, the sliding forward of the lower jaw in the glenoid cavity brings the higher second molar in the lower, in continuous contact with the first superior molar, as well as both outer and inner cusps of bicuspids and molars of the upper and lower jaw. This is specially done to equalize the pressure and force on both sides or parts of the dental arches. This permits of the most compensating arrangement of the teeth for equalizing the action of muscles on both sides simultaneously, and getting the greatest amount of grinding surface at each movement. This arrangement of bicuspids and molars is found in nearly all the lower animals; the incisors, however, never touch when the jaws are in lateral movement. Turn the lower jaw to either side and the effect is the same. As I before said, but one side of the mouth can be used at the same instant, leaving the other free to balance the other side at work.

If the upper arch of incisors of the natural teeth should be broad or deep on account of the thickness of the base or body of the incisors, or where

they are much inclined to protrude, then the arch at the ramus is not so great. In artificial sets this need never occur, carrying out the same rule in nearly every case, of controlling the curvature at the ramus, by the depth of overbite, and length of cusps of bicuspids. This system holds good in partial sets as well.

This constitutes all that is necessary to be said on articulation proper; it remains only to give a few points having a bearing on the perfection of the same. Select the broadest grinding surfaces to bicuspids and molars, that the bolus of food may be held securely on their faces, taxing less the muscles of the face engaged in mastication. Narrow surface would rather tend to cut the food than grind it. This is of no mean importance in rendering artificial teeth of greatest use.

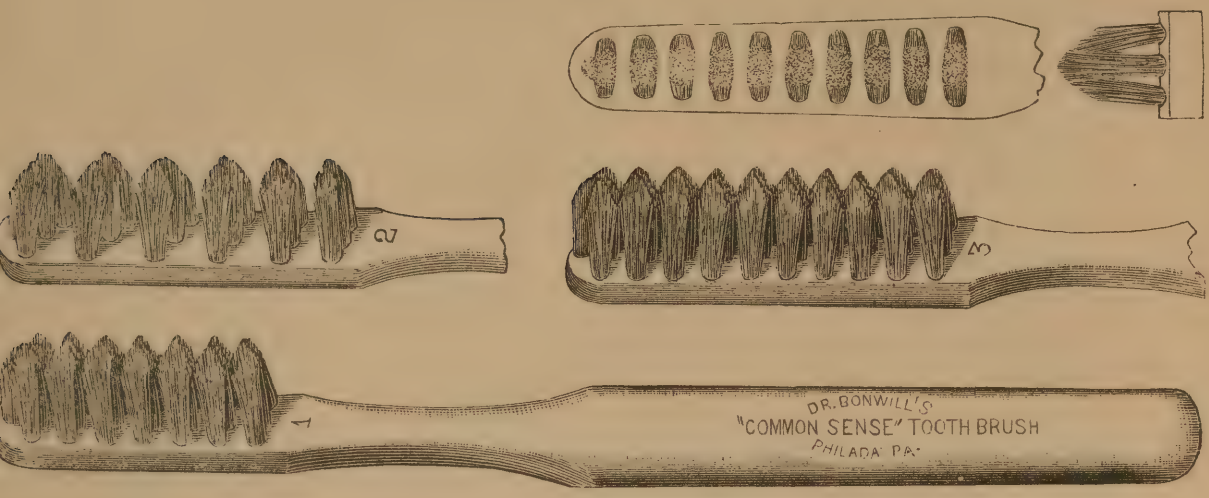
To produce the most natural effect the centrals should be the lightest in color, and the cuspids a shade or so darker, with a difference in color of all the back teeth. I prefer on this account to set plain teeth wherever admissible—and nearly all lower cases are so—and use different shades and arrange irregularly. The lower incisor teeth are mostly crowded, and I find to lap them over and distort them, even to a great extent, adds very greatly to their natural appearance. Don't be afraid of getting any case too irregular; very few natural sets can boast of perfect symmetry.

In conclusion, gentlemen, let me again impress you with the importance of cultivating mechanical art in your calling; for I can assure you that it will pay tenfold, in increasing your usefulness as operators in every department, and in giving you powers of conception, to lead the way to original ideas and more practical development.

The regular meeting of the Odontological Society of Pennsylvania was held Saturday evening, November 7th, 1885, at the office of Dr. Tees, 548 North Seventeenth street, President Darby in the chair. The following paper was read:

THE PHILOSOPHY OF THE TOOTH-BRUSH—ITS CONSTRUCTION AND PROPER USE.

BY W. G. A. BONWILL, D. D. S.



I am not aware that any one has ever written a dissertation upon this subject. There has been some talk on the hygiene of the mouth, during the past year, but no one has attempted to explain the philosophy of a tooth-brush: how it should be constructed, and its proper use. It is a lamentable fact that but little thought and ingenuity has ever been given to it, although thousands of shapes have been furnished by dentists and others. I must confess to my own shortcomings, up to the year 1876. I had not, up to that date, ever sold brushes, powders or washes from my office. It looked too much like trading. I always told my patients to go to drug stores and select for themselves.

My attention was arrested, in 1876, by two remarkable cases: Two bachelor brothers had left their dentist on account of not being able to arrest the disease which, he said, was fast cutting their teeth away, both upper and lower. It was noticed that a groove near the cervix on the buccal and labial sides, as far back as the second molars, was being cut. The dentist said it was a disease, and more care must be taken. The brush, with washes and powders, must be applied thrice daily. The apparently specific disease spread, in epidemic form, with both brothers. Filling was resorted to, but with little good results. It was looked upon as an incurable disease, the only remedy being brushing.

When they came to me they were frantic.

In making my diagnosis, I was satisfied, from my previous experience, that the whole trouble arose from the injudicious use of the brush and powders. They spent fifteen minutes after each meal in this work of preservation, as they thought, and once before retiring. They seemed to

have nothing to do but think of their teeth and how they should avert the calamity impending. The filling that had been done was well consolidated, and calculated to have saved from action of caries alone. But nothing could withstand such friction as had been kept up for years. The bristles did not cut the gold, but the enamel went on to destruction around the edge of the fillings. The younger brother, about forty-five years of age, had lost the six superior incissors from having been cut so far through from the labial side that they broke off; and the lower were gone so nearly to the pulp canal as to endanger them. In fact, wherever he could bring the brush into action by abrasion across the surface of all his teeth, even upon the palatal and lingual sides, the effect was evident.

I had seen many cases where the teeth had been abraded, but these surpassed all.

In making up my decision, it was necessary to determine whether there could be such a factor as disease, in such cases, or whether it was from the brush and dentifrices, with washes, &c. Some of the best practitioners had held that there was some specific action going on in the secretions of the mouth, *but had never given the crucial test to substantiate their assertions.* My own experience, hitherto, had fully assured me that there was but one cause—the *Brush* and the incidentals. I could see nothing else, in these cases, and so decided. I at once changed the whole state of affairs. Of the results of my diagnosis and prognosis I had no doubt. I selected them a small brush, and, as a powder, prepared chalk. They were directed to use the brush by simply placing it in one spot and pressing the bristles directly between the teeth with a rotation of the brush; not to rotate the wrist and brush up and down from the gums to cutting edges; avoiding the old method of drawing the brush across the teeth; not to consume more than two minutes after breakfast and supper, using powder but once daily. The denuded or abraded teeth were contoured with gold (Abbey's No. 5, soft), and by hand pressure. I have seen them twice yearly, ever since 1876, and I can assure you that no recurrence or spread of the trouble has taken place in the least.

There were many such cases about that time coming to me, and I felt it a duty to construct a brush which, from the study of these phenomena, would obviate or anticipate it. While I differ with many of you, I must repeat that I *have never seen a case where the teeth had been generally eroded, but could be accounted for by friction, and nothing else.*

There is one particular form of groove that has caused so many to believe it was from disease. It seems easy to attribute it to the brush, so long as the groove is a shallow concave; but where the edge of the groove, on the side nearest the cutting edge, is an acute angle, and forming a sharp corner, the brush is not a factor. It would seem impossible to make such a shaped groove with a yielding substance like bristles. When it is carefully studied, however, one must admit it possible and certain. The brush, in nearly every case, has been driven across the surfaces of the teeth, in conjunction with powder, with a great force exerted upon the bristles, to press them upon the teeth, and produce friction. A groove, it will be

admitted, is soonest made near and at the cervix by first wearing away the gum, when the bristles can touch the dentine. In many cases of rather flat teeth, the groove is lower. Sometimes not a groove, but indentation on the surface, with intervening patches of hard enamel untouched, or only partially so.

Now, when you consider how much force has to be brought to bear to keep the brush in contact with the teeth, and the brush being too wide and too long, with the bristles too close together, if a groove is made at all, then, as soon as commenced, and an edge or boundary line is made, the bristles can no longer keep on the line, but divide, and the body of the bristle—not its end or point—is constantly in friction against this line, making it at first as sharp as a razor, and keeping it so. If you could keep the bristles on this brink of the groove, then it could not occur.

Another reason why the groove commences at or near the cervix is, that there is less resistance to the brush from the neck being narrower; besides, there is a less body of the tooth presented. It is there the gum forms a boundary line to control the bristles, to keep them in file in their ranks, standing up squarely to their work, while those on the flatter body of the tooth go straddling about as if intoxicated. Then, as soon as the slightest grove is made, the bristles are bound like men to go in the *rut*. When the cuspids, bicuspids, and molars are the prey, you never see these groves except close under the edge of gum, never upon their broadest surfaces. There is one phenomenon that seems not to be in keeping with this explanation and it is the unfathomable paradox to all who hold to a specific cause. How is it possible while the brush is made to pass across the surfaces of the incisors that, in addition to a groove or grooves, there should be a hill and plane surface produced? Why not the groove, as near the cervix. This is not at all wonderful. I am quite sure that no round face tooth was ever so defaced. That it is to be found only in those cases where the enamel has given previous evidence of its surface being made up of cells of unequal value, which we so often witness? Who has not observed the surfaces of the hardest rock subjected to the constant attrition of water, and the debris therein, cut in a similar manner, whether the grain of the rock was lying lengthwise or crosswise. Something must give way where a force is exerted; and here, where the face of the tooth is flat and the bristles can be kept upon the surface without straddling, if one portion is softer than another there will be loss of structure irregularly. These reasons are sufficient to convince me that no other cause need be given for these phenomena. As soon as the excavated surfaces are filled and the brush used in moderation and with judgment, there will be no recurrence in any case.

You will understand from what has been said that I consider all cases where the labial, buccal and palatial surfaces are denuded, either in grooves, or when the broad surfaces of the centrals are involved near the cutting edge, it must be attributed to the brush and powders; yes, to washes also indirectly. You will never find it where a brush has not been used. The only thing answering to the specific theory is around the

cervix where the brush has first worn the gum away, and caries taken the place of the brush, which latter can no longer be used without pain, and the parts are neglected. But, it is of an entirely different nature from the hard polished surfaces from attrition. While these surfaces are not so polished as those lower down toward the cutting edges, yet, they are partially so and the dentine is harder, nevertheless, it can be arrested at once by proper filling, as can all evaded surfaces, if the brush is also properly used. It matters not whether from disease or by friction, the remedy is all the same and equally effective. If it were caused by specific action nothing mechanically would avail. If I am not correct in my view and a specific cause is at work, will it make the case any better by continuing to use the brush either across or up and down? Not at all. Take for granted we know no cause for this vandalism. Can we not institute some more philosophical means of grappling with this monster? Is there a brush that has ever been in the market or in the private practice of any dentist which has any claims to a construction that will reasonably do the work for which they were designed and not cause mischief? I unhesitatingly answer, No!

What are the issues to be met? Will any one here say that, with the brushes to be had he can cleanse the teeth without producing *pressure*, and, the resultant *friction*. All will admit that, if the teeth can be cleansed, and well up under the cervical edges, without any possibility of abrasion on the enamel and lacerating or wearing away the gum, it should be the practice. Can we hope to do this with such brushes as we are compelled to buy? It is absolutely impossible, without the greatest care and vigilance, to guard against the crosswise movement which is first learned in youth. It is kept up through thoughtlessness, the dentist, until within a few years, seldom called attention to the practice. It becomes a second nature and, when they *are* advised as to the extent of the mischief done by their suicidal hands, it is frequently too late.

Then to cleanse the teeth, *we must produce more or less friction*, how shall it be done with the least pressure upon the handle of the brush, and what style or construction shall it have? And further, shall any powder or wash be used, and if so in what form? Should a wash ever be sold by any dentist or advised? Let us look at the construction of the average brush. The handle is evidently made to allow the patient to grasp it with the whole hand; for without this, it could not be held steady with such a mass of bristles at the opposite end. Look at the arrangement of those bristles. Four and five rows in width and seldom less than two inches in length and every bundle of them in holes as close as soldiers in solid column, ranging from soft to very hard, and no allowance in quantity made for the difference in their flexibility. Did you ever for a moment stop to think that such a mass was never designed to cleanse the human teeth or those of any of the lower animals? Reflect how much pressure must be exerted on such a solid phalanx to drive them between the teeth! Should you be able to get them, there, at what expense must it be upon the gums from the direct pressure alone; and, if any move-

ment is made to create friction, the pressure must be constantly kept up or the bristles will not, for a moment, remain, except upon the periphery of the tooth opposite the radius. You see now how in keeping the large handle is with the necessary force to be exerted from the dense column of bristles forming the apparatus designed for the end in view. How few of the bristles can be expected to reach their destination by any movement possible? The friction of course is immense. How much of the length of the standard brush at any one time, or at all ever comes in contact with the teeth? In a word, how much material do you suppose can be dispensed with in making of a brush and be more effective? How much smaller and shorter can the handle be and give you control over the bristles while in the mouth? How much less friction can be produced for all practical purposes without so much pressure as hitherto exerted upon the standard brush? How much time can be saved? How much more pleasure can be assured? How much greater inducement, can be offered to those who now consider it a nuisance to brush their teeth? How much less risk can be guaranteed to those who know they have rather invited caries by their lifelong attention than they have been benefitted? How are we to please the baby and older child and not disgust them with such an enormous mouth full of what is more fitted for scrubbing steps than human teeth. Had I not fancied I could answer all these queries in the affirmative I should not have troubled myself to tax your weary brains with the result of six years labor and observation; I cannot let the matter pass without doing what I consider a duty and a privilege.

Then, if *friction* must be produced in order to cleanse the teeth shall it be applied with a large or small brush; one thickly studded with bristles or one with them far apart in length and width? Shall it be applied crosswise or lengthwise the axis of the tooth? Shall we use powder or washes and how often and what kind?

As the teeth are of various shapes, and all of them with rounded faces. I claim it is impossible to use the standard brush, even once a day without injury being done to both teeth and gums. In the first place then, as we must reach all the surfaces of the teeth, I adopt a stiff bristle and set it in rows lengthwise, double the distance apart of any other brush, and only long enough to cover about four teeth. There are three rows crosswise, and the holes in the handle are drilled to make the bristles converge or lean toward the centre, occupying but a trifling width on the face of the brush. Each row of bristles is pointed to give least resistance. The face of bristles, are again rounded from side to side to prevent them from touching the gums, before the teeth. The handle is made short and small in every way to prevent the hand from grasping it as if great force were to be exerted. It is flat to allow the tips of the fingers merely to touch it, to keep it from turning or rotating upon itself. The brush is narrower at the end or tip since the molar teeth are so much shorter than the others.

With such a brush, the teeth would soon be slaughtered if some special way of using it be not devised. *It is on just this point that all persons*

need to be educated. The plan cannot be well applied with the old style brush. My theory is the ends of the stiff bristles should be simply laid on the surface of the teeth and without forcing them across, press them down upon the faces of the teeth and force the bristles between them like so many toothpicks, pricking or piercing the particles on and between them, and at same time make the slightest rotary motion, and never, at any time enough to force them out of the spaces between the teeth. When one part is done go around the mouth on all the surfaces. The arrangement and distribution of the bristles is such that the small handle is sufficient to press the bristles home with ease and make it impossible to inflict any injury upon teeth or gums.

To still further make the friction less, the brush should be used immediately after a meal and never before, while the accretions upon the teeth are yet soft. One very light brushing at the proper moment will be most effective.

While Brush No. 2 will cleanse the palatal and lingual surfaces well, it can be done better with Brush No. 1, which is much smaller. If I were compelled to make use of one only, I would take the smaller, or No. 1.

This *new feature* of direct pressure without lateral movement, can only be done with a small brush—short and narrow, and but few and stiff bristles.

Here is where the mischief is done from having to force such a dense body of bristles on and between the teeth. This baby-brush meets the issue.

It is claimed that powders do much injury. I do not see it. Think again! The dry powder is taken upon the moistened brush and as soon as it is in the mouth the saliva floods the brush and the powder drops on the tongue, unless the brush is a very soft one. The mischief is done by the friction of the brush and not by the powder. If we must use powders (and I grant they are very excellent), let us compound them with soap, or something to "hold the powder in solution," as the druggist would say. This would be sure to keep in the brush and do execution without so much friction from the brush. I know of nothing better than the finest pumice incorporated in fine castile soap. The soap keeps the powder suspended, and, at the same time, prepares the surface of the tooth for the powder to do its work with least abrasion by removing the grease therefrom.

Shall washes be used in conjunction with a brush? I never sold such from my office at any time in my life, nor advised them. If the gums are diseased, no wash, such as is given to patients, will ever cure or harden them. The dentist should first cleanse the mouth and teeth and remove all causes for future trouble, and make one or two applications of concentrated remedies. This will suffice; at least it does with me. I can conceive of no motive in any first-class dentist recommending washes, further than from his ignorance of therapeutics, or a mere love of making sales.

I do not know that I can present the subject more clearly, except by

personally demonstrating that the simplicity of their adaptation is fully as philosophical as their construction; and the only improvement which I can now see, is to make them yet smaller and the bristles wider apart.

I will further state that the No. 1 is just what we want for our patent rubber and gold plates. It finds the secretions.

Now, gentlemen, I must beg pardon for brushing you up so sharply and consuming so much time over a mere tooth-brush. If I have transcended proper bounds and given you false philosophy, you now have a chance to set aside my teachings.

DISCUSSION.

Dr. Register.—I am pleased with that part of Dr. Bonwill's paper which relates to the curtailing of the brush; I believe that brushes are made too large, but it is folly to assert that they are always the cause of erosion. The reason I asked Dr. Bonwill if his brush would cleanse the approximal walls by a wriggling movement, was simply to ascertain the extent of its utility, for it is these walls that we have the greatest difficulty in keeping clean. I do not think a brush can be made to thoroughly cleanse the teeth. The use of compressed air in my practice has forcibly brought to my mind how full of foul matter these interstices are, and I am now advising the use of an atomizer as excellent practice in connection with the brush and floss silk. The evolution of an acid action in an atmosphere of fetid matter, takes place principally at night, in the absence of salivary irritation. I do not believe it is a free acid that robs perfect enamel of its lime salts. In using my air apparatus up to 30 to 40 pounds pressure, I am astonished at the unloading of greasy matter from the interstices between the teeth. In pyorrhea alveolaris it removes all foreign matter, so that the tissues have a chance to resume a normal condition. Any atomizer throwing an uninterrupted stream will answer. An alkali, such as lime-water, should be used with a special medication when called for.

Dr. James Truman.—Dr. Bonwill's assertion that abrasion is not caused by the tooth brush, is probably true in the sense that the constant use of the bristles over the emamel will not have that effect; but it must be remembered that powder in some form is nearly always used with the brush, and when used it may cut as sand cuts marble. The objection to powder, and I regard it as a serious one, is the irritation produced upon the gums; this, while scarcely noticeable to the individual, gradually produces absorption at the gingival borders. This in time invites pyorrhea alveolaris and kindred pathological conditions. Greater care is necessary in the use of cleansing agents; charcoal will produce a bluish discoloration of the gums; toothpicks are terribly destructive to the gum margins and pericementum. Dr. Bonwill's tooth brush No. 1, is a good idea, but neither tooth powder nor pumice should be used with it as a daily practice; the use of them should be mainly confined to rubbing with a piece of soft wood and that directly upon the accretions on the teeth.

Dr. D. Neall.—It seems to me that any process of cleansing the teeth,

even by a brush of the most approved kind, which stops short of the thorough cleansing of the approximal surfaces, will be insufficient. The interstices should be kept clean by the daily use of silk thread or even cotton. A simple and small brush, with the handle and back corresponding to the curvature of the teeth, such as I now show you, and which I adopted twenty years ago, should be used. Patients should have impressed upon them that "cleanliness is before godliness"—in care of the teeth and mouth—and all agents and appliances should be simple.

Dr. Tees.—For thirty years I have daily used tooth powder with the brush, in cleansing my own teeth; my children also have used it daily since babyhood, and I fail to find any ill effects from its use. Tooth powders contain but a small quantity of gritty substances, being largely composed of chalk and orris root and but a small proportion of pumice, I do not advise the daily use of soap for cleansing the teeth; on account of its alkalinity, it acts upon the dentine in the same manner that acid acts upon the enamel. I approve of the size of Dr. Bonwill's brushes.

Dr. James Truman.—The idea that alkaline solutions act upon tooth structure is certainly an erroneous one. I have kept teeth in a strong alkaline solution for over a year, without the slightest effect, either upon the inorganic or basic substance (organic). The enamel was tested by microscopic examination and the latter by decalcification and examination of the resulting tissue. The examination of mouths of persons who have made an habitual use of soap gives the same result. In regard to abrasion ascribed to the tooth brush, I must say that it has a very different origin, which to my mind has not been recognized; it is a prominent cause of caries, but has not been taken into consideration at all. I allude to the change of oral secretions from the neutral to the acid in a state of rest. It is not necessary to enlarge upon this, but I have satisfied myself by careful tests on my own mouth, that a marked acid reaction is the result of a test at this period. The lips hold the oral secretions against the labial surfaces of the teeth, and abrasion results. Antacids are indicated at night more than at any other period in the twenty-four hours, and there is nothing better than *creta prep.* for this purpose.

Dr. E. H. Neall.—In view of the fact that the saliva is frequently in a state of morbid alkalinity, a certain chalk-like decay may thus be accounted for. Dr. Taft says that alkalies will act upon the animal portion of the dentine and remove it, and in cases thus produced, the residue is friable and chalk-like.

Dr. Dixon.—I have seen teeth very much denuded in the mouth of a patient who never used a tooth brush.

Dr. McQuillen.—In my experience, I find the hardest teeth are the most denuded. I saw a patient to-day, whose teeth were badly eroded in places where the brush does not touch.

Dr. Noble.—I have seen the same discoloration of the gums, alluded to by Dr. Truman as being due to the use of charcoal, produced by some systemic cause.

OFFICERS.

1886.

PRESIDENT.
H. C. REGISTER.

VICE-PRESIDENT.
E. C. KIRK.

RECORDING SECRETARY.
AMBLER TEES.

CORRESPONDING SECRETARY.
H. K. LEECH.

TREASURER.
E. H. NEALL.

LIBRARIAN.
W. G. A. BONWILL.

EXECUTIVE COMMITTEE.
J. W. NOBLE, S. H. GUILFORD,
JAS. TRUMAN.

CONSTITUTION.

ARTICLE I.

NAME.

This Association shall be known as the Odontological Society of Pennsylvania.

ARTICLE II.

OBJECT.

The object of this Society shall be the diffusion of the principles and the development of the best modes of practice in the Art and Science of Dentistry. It shall be devoted solely to the interests of the Dental Profession. If found practicable, it shall aid in the establishment here or elsewhere of an independent Journal devoted to the interests of Dental Science.

ARTICLE III.

OFFICERS.

The Officers of this Society shall be elected from the list of *Active* members, and shall consist of a President, Vice-President, Recording Secretary, Corresponding Secretary, Treasurer, Librarian, and Executive Committee of Three.

ARTICLE IV.

COUNCIL.

The Officers of this Society shall constitute a Council for the proper conduct of the Society, and a Court for the trial of any member against whom charges may be made of violation of the Code of Ethics; and shall report the result at the next stated meeting for final action of the Society.

ARTICLE V.

MEMBERSHIP.

SECTION 1. This Society shall consist of *Active* and *Honorary* members.

SEC. 2. All candidates for *Active* members shall be practitioners of Dentistry in the State of Pennsylvania or the adjacent States, and graduates in Dentistry or in Medicine.

SEC. 3. Honorary members may be elected from among those whose services to the Dental Profession entitle them to such recognition.

SEC. 4. Whenever the list of *Active* members shall contain twenty-five, the Society shall be divided into sections, viz:—

Dental Histology and Microscopy.
Dental Pathology.
Operative Dental Surgery.
Dental Prosthesis.

Each member to have his choice of Sections. Each Section shall have one officer to be called Chairman, who shall make yearly reports of his Section. The report of each Section to be made on alternate meeting nights. The Sections shall be re-formed annually.

ARTICLE VI.

CANDIDATES.

The names of all candidates, whether for Active or Honorary membership, shall be referred to the Executive Committee through the Recording Secretary, who shall be empowered to receive such application. The Executive Committee shall have power to dismiss any application, without recommendation to the Society for final action, should they find sufficient reason for so doing. Having received the endorsement of the Executive Committee, the name of the candidate shall then be brought before the Society, and two-thirds vote of the members present shall elect.

ARTICLE VII.

ELECTIONS.

SECTION 1. All elections shall be by ballot.

SEC. 2. In election of Officers, a majority of all the votes cast shall be necessary to a choice. In case of failure to elect at the first ballot, the two persons receiving the highest number of votes shall be the nominees on the second ballot.

ARTICLE VIII.

SEAL AND CERTIFICATE.

This Society shall possess a Seal and a Certificate of Membership.

ARTICLE IX.

APPROPRIATIONS.

No appropriations of the moneys of this Society shall be made without two-thirds vote of the Council, and a two-thirds vote of all *Active* members present at a regular meeting.

ARTICLE X.

BY-LAWS.

By-laws for the further regulation of this Society may be enacted from time to time, as required.

ARTICLE XI.

AMENDMENTS.

Proposed changes in the Constitution shall be made through the Council at any regular meeting, and discussed and acted upon at the next alternate meeting; but it shall not be altered or amended except by a three-fourths vote of all the *Active* members present, and all Active members shall be notified of the proposed change.

BY-LAWS.

ARTICLE I.

DUTIES OF OFFICERS.

President.

SECTION 1. The President shall preside at all meetings of the Society; decide all points of order subject to appeal, and give a casting vote; and sign all certificates of membership. In the absence of the President and Vice-President, the Chairman of the Executive Committee shall preside. In deciding all questions not otherwise provided for in the Constitution and By-laws, the Presiding Officer shall be governed by the usual parliamentary rules.

Recording Secretary.

SEC. 2. The Recording Secretary shall keep a correct record of all the proceedings of the Society, and sign all certificates of membership. He shall prepare for publication such of the transactions and papers as shall be of general interest to the profession, and deliver them to the Executive Committee. He shall also render a report of his proceedings at the annual meeting or on order of the Society.

Corresponding Secretary.

SEC. 3. The Corresponding Secretary shall conduct the correspondence of the Society, shall bring to the notice of the Society all letters received by him during the month, and shall take charge of and preserve them carefully. He shall notify all members and officers of their election; committees of their appointments and subjects referred to them; and members of the times and places of meeting. He shall keep a record of membership, including resignations and other changes; shall keep the manuscript Constitution and By-laws of the Society, and perform such other duties as his office may require. He shall also render a report of his proceedings at the annual meeting or on order of the Society.

Treasurer.

SEC. 4. The Treasurer shall receive and take charge of all funds belonging to the Society, and make disbursements from such funds only on the order of the President and Chairman of the Executive Committee. He shall submit a report of his accounts, with vouchers for all moneys expended, at the annual meeting or when required by a vote of the Society, which account shall be audited by the Executive Committee. Previous to the annual meeting he shall notify all members whose dues may be in arrears for more than two years, and demand the payment of the same.

Librarian.

SEC. 5. The Librarian shall take charge of all books, papers, periodicals, specimens, instruments, etc., belonging to the Society, to which he shall allow all members free access, and of which he shall compile and keep a catalogue. He shall take charge of the Seal of the Society, and of the Certificates of Membership; prepare and seal such Certificates; obtain the signatures of the President and Recording Secretary thereto, and forward them to members. He shall render a report of his proceedings and the condition of his department at the annual meeting.

Executive Committee.

SEC. 6. The Executive Committee, with the President as auxiliary, shall attend to all business not otherwise especially apportioned. Its members shall be residents of the place of meeting of the Society. It shall take cognizance of all applications for membership; shall provide subjects of investigation and discussion, and appoint Essayists. It shall attend to the publication of the proceedings furnished by the Recording Secretary, and conduct the correspondence relative to these and other scientific proceedings. It shall act as Auditor, and transact such other business as may be required by the Society. It shall also render a report of its proceedings at the annual meeting, or when required by a vote of the Society.

SEC. A. The Executive Committee shall, at the annual meeting in May, report the names of one member for each month, whose duty it shall be to prepare an original essay upon some subject in dentistry, and present the same at the meeting for which he was appointed.

SEC. B. At the same meeting in May shall also be appointed one or more substitutes for each month, whose duty it shall be to take the place and perform the duty of the principal in case of failure on his part.

SEC. C. The essayist shall notify the Corresponding Secretary, two weeks in advance of the meeting, giving the title of his essay.

SEC. 7. All the officers of this Society shall serve without compensation except the Recording Secretary, who shall receive twenty-five dollars annually for his services.

ARTICLE II.

PRIVILEGES OF MEMBERS.

SECTION 1. The *Active* members only of the Society shall be entitled to vote and hold office.

SEC. 2 Honorary members shall be entitled to all other privileges.

ARTICLE III.

FEES AND DUES.

SECTION 1. *Active* members shall sign the Constitution and By-laws, and pay an initiation fee of three dollars, and annual dues of two dollars, payable at each annual meeting.

SEC. 2. When the dues of a member shall be in arrears for more than two years and remain unpaid after a demand by the Treasurer, the delinquent shall forfeit his membership and his name shall be stricken from the roll.

SEC. 3. One-third of all fees and income of the Society shall be set apart as a fund to aid the establishment of an independent journal devoted to the interests of Dental Science.

SEC. 4. This fund shall be called the JOURNAL FUND, and shall be placed at interest in secure deposit, and remain intact for the aforesaid purpose. It shall only be drawn upon in agreement with resolution from the Society and by checks to be signed by the Treasurer and endorsed by the President.

SEC. 5. If for good and sufficient reasons, should the above plan at any time be found impracticable, then by the unanimous consent of the Executive Committee and three-fourths vote by ballot of all the Active members present, said fund may be devoted to the purchase of books or instruments of observation for the use of the Society; but shall not be used for these purposes until two months after the resolution shall be offered, each member being notified of the form of the resolution and date of its consideration.

ARTICLE IV.

OF MEETINGS.

SECTION 1. Regular meetings shall be held at the residences or offices of the members on the first Saturday of each month, except

July and August, at 8 o'clock P. M., at which five shall constitute a quorum.

SEC. 2. Special meetings shall be called by the President at the written request of any three members, and no other subject shall be considered except the one for which it is called.

SEC. 3. An annual meeting of the Society shall be held on the first Saturday of May to receive the reports of the officers, for the election of officers and delegates, and the transaction of such business as may promote the welfare of the Society. Vacancies may be filled during the year as they occur.

ARTICLE V.

ORDER OF BUSINESS.

The Order of Business at the Regular meetings shall be as follows:

1. Reading of Minutes.
2. Reports of Committees.
3. Unfinished Business.
4. New Business.
5. Election of New Members.
6. Reports of Sections.
7. Reading of Papers and Discussions thereon.
8. Incidents of Practice.
9. Announcement of Committees by the Presiding Officer.
10. Adjournment.

ARTICLE VI.

PUBLICATION.

The Society shall have the right to publish any paper read before it.

ARTICLE VII.

QUALIFICATIONS OF STUDENTS.

SECTION 1. Members of this Society, taking office students, shall require of the latter satisfactory evidence of a sufficient preliminary education, the minimum of which shall consist of a thorough knowledge of orthography, reading, writing, arithmetic, grammar, geography, together with a knowledge of the principles of physics.

SEC. 2. A diploma from any chartered literary institute shall be deemed sufficient evidence of an applicant's preliminary educational qualifications.

SEC. 3. It shall be the duty of a properly appointed Committee of

Three Members of this Society, to examine the applicants for admission as students in the office of members of this Society, when so requested to do by a member. *Passed, November 5th,* 1881.

ARTICLE VIII.

AMENDMENTS.

Proposed changes of these By-laws shall be made through the Council at any regular meeting, and discussed and acted upon at the next alternate meeting; and all the *Active* members shall be notified of the proposed change.

RULE I.

PROTECTION TO INVENTORS.

The Odontological Society of Pennsylvania, appreciating all efforts made in behalf of the profession to originate and improve instruments, etc.

Resolved, That this Society will be pleased to record all original matter, such as superior material for filling, modes of manipulation, useful instruments, or anything in mechanism pertaining to the practice of dentistry; and as a scientific body, will extend to such originators its sympathy and protection.

PROVIDED, Said applicant deposits a specimen model or specification with the Librarian and demonstrates the same before this Society or a Committee, as this Society may elect, with satisfactory evidence of its originality, and afterwards submits the same to a Standing Committee for approval. *Passed, May 3d,* 1879.

RULE II.

PUBLICATION OF PROCEEDINGS.

This Society shall give its monthly proceedings for publication to the Dental Cosmos, excepting those for the months for February, June, and November, and the proceedings for these months shall be given for publication to the Dental Office and Laboratory. *Passed, September 6th,* 1879.

This rule, as far as it relates to the Essays, is rescinded. *Passed, June 10th,* 1882.

RULE III.

REVISION OF ESSAYS.

A Committee of Three shall be appointed, whose duty is shall be to revise all Essays presented to the Association, the author of the Essay to be one of this Committee. *Passed, May 6th,* 1882.

RULE IV.

PRINTING OF NEW RULES.

Amendments to the By-laws and Rules passed each year, shall be printed and sent to each member, to paste in his copy of the Constitution and By-laws. *Passed, Nov. 4th,* 1882.

CODE OF DENTAL ETHICS OF THE ODONTOLOGICAL SOCIETY OF PENNSYLVANIA.

SECTION 1. The dentist should fully recognize the obligations involved in the discharge of his duties towards his patients. As they are in most cases unable to correctly estimate the character of his operations, his own sense of right must guarantee faithfulness in their performance.

SEC. 2. A member of the Dental Profession is bound to maintain its honor and to labor faithfully to extend its sphere of usefulness. He should avoid everything in language and conduct calculated to discredit or dishonor his profession.

SEC. 3. It is unprofessional to resort to public advertisements, handbills, posters, or signs calling attention to peculiar styles of work, lowness of prices, or special modes of operating; or to claim superiority over neighboring practitioners; to publish reports of cases or certificates in public prints; to go from house to house to solicit operations, or to perform any other similar acts.

SEC. 4. When consulted by the patient of another practitioner, the dentist should guard against inquiries or hints disparaging to the family dentist, or calculated to weaken the patient's confidence in him; and if the interests of the patient will not be endangered thereby, the case should be temporarily treated and referred back to the family dentist.

SEC. 5. When general rules shall have been adopted by the majority of practitioners in the same locality in relation to fees, it is unprofessional and dishonorable to depart from them, except when circumstances require.

Members of the
ODONTOLOGICAL SOCIETY OF PENNSYLVANIA.

Charles J. Essig,	E. T. Darby,	S. H. Guilford,
H. C. Register,	Daniel Neall,	J. W. Noble,
Ambler Tees,	J. A. Woodward,	W. M. Beardslee,
H. C. Longnecker,	W. G. A. Bonwill,	F. R. Faber,
E. H. Neall,	C. A. Kingsbury,	Saml. Haines,
Robert Huey,	H. K. Leech,	Geo. Roberts,
F. M. Dixon,	M. L. Long,	G. F. Milliken,
Louis Jack,	J. L. Baker,	J. H. Campbell,
Joseph Pettit,	D. N. McQuillen,	R. J. Nickell,
James Truman,	J. B. Wood,	I. S. Fogg,
Theo. F. Chupein,	S. B. Luckie,	Alonzo Boice,
E. C. Kirk,	C. R. Jefferis,	L. Foster Jack,
S. E. Gilbert,	C. E. Graves,	A. G. Bennett,
J. D. Thomas,	C. F. Bonsall,	C. H. Littleton,
T. W. Buckingham,	J. C. Townsend,	L. A. Faught,
H. M. Sheppard,	W. L. Cave,	G. L. S. Jamison,
J. R. Yorks,	J. S. Gilliams,	E. P. Quick,
James Martin,	F. F. Robinson,	J. N. Broomell,
Wm. Diehl,	J. A. Hartman,	F. D. Gardiner,
J. Judson Edwards,	Robert S. Ivy,	Harry B. McFadden.

Honorary Members.

Jas. W. White,

Henry Leffmann.

Deceased Members,

Marshall H. Webb, died January 1st, 1883, in the 39th year of his age.

Thomas L. Buckingham, died September 4th, 1883, in the 68th year of his age.

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